Bigint Computing Journal, Volume 3, Issue 1, January 2025, pp. 1-10

Bigint Computing Journal
Open Access
Publisher Ali Institute of Research and Publication

Designing a Mobile-Based Employee Information System Using the Design Thinking Approach

Perancangan Sistem Informasi Kepegawaian Berbasis Mobile Menggunakan Pendekatan Design Thinking

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A B S T R A C T

This research focuses on enhancing workforce management at PT Perkebunan Nusantara IV by implementing a mobile-based personnel information system. The study addresses inefficiencies in manual HR processes, such as delays in task approvals and limited accessibility to employee data. By applying the Design Thinking methodology, the research identifies key challenges, generates solutions, and tests prototypes to develop an intuitive system. The final product improves workflow efficiency and user satisfaction, as demonstrated by usability testing results. Limitations include dependency on internet connectivity and the scope of testing. Future developments could integrate predictive analytics and expand features for comprehensive HR management.

Keyword: Design Thinking, Employee Management, Mobile Application

A B S T R A K

Penelitian ini berfokus pada peningkatan manajemen sumber daya manusia di PT Perkebunan Nusantara IV dengan mengimplementasikan sistem informasi kepegawaian berbasis mobile. Penelitian ini mengatasi ketidakefisienan dalam proses HR manual, seperti keterlambatan dalam persetujuan tugas dan keterbatasan aksesibilitas data karyawan. Dengan menerapkan metodologi Design Thinking, penelitian ini mengidentifikasi tantangan utama, menghasilkan solusi, dan menguji prototipe untuk mengembangkan sistem yang intuitif. Produk akhir meningkatkan efisiensi alur kerja dan kepuasan pengguna, seperti yang ditunjukkan oleh hasil uji kegunaan. Keterbatasannya meliputi ketergantungan pada konektivitas internet dan cakupan pengujian. Pengembangan di masa depan dapat mengintegrasikan analitik prediktif dan memperluas fitur untuk manajemen HR yang lebih komprehensif.

Kata Kunci: Design Thinking, Manajemen Karyawan, Aplikasi Mobile

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DOI: https://doi.org/10.55537/bigint.v3i1.988
Received: 2024-12-01; Revised: 2025-01-24; Accepted: 2025-01-24

1. INTRODUCTION

In the modern era, human resource management has become a critical focus for organizations. The growing awareness of the importance of effective personnel data management has driven efforts to find innovative solutions to administrative challenges. As technology continues to evolve, it enables the transformation of

traditional practices into modern solutions, leveraging existing technological advancements [1]. In today's context, the need for computerized systems is undeniable, as they provide convenience in accessing essential information [2]. Information systems, one of the most significant results of current technological progress, can be defined as a structured combination of people, hardware, software, and databases that collect, process, and distribute information within an organization [3]. This highlights the critical role of information systems in helping organizations manage operational activities effectively.

PT Perkebunan Nusantara IV, a company in the palm oil agroindustry, faces a growing need to manage an increasing number of employees across several branches and divisions. Currently, personnel data management is still performed manually using physical files and Microsoft Excel. These manual processes often lead to inefficiencies, human error, and scalability issues, which highlight the need for innovative solutions tailored to the evolving demands of modern organizations. This research focuses on addressing these challenges at PT Perkebunan Nusantara IV by leveraging the Design Thinking methodology to develop a mobile-based workforce management system.

Manual workforce management systems often result in inefficiencies, delays, and a higher risk of data inaccuracies. At PT Perkebunan Nusantara IV, these challenges are amplified by the large and dispersed nature of the workforce. Time-consuming tasks such as leave applications and attendance tracking reduce overall productivity.

Staffing applications, or software systems, are increasingly used by companies to manage various aspects of employee operations. These applications automate and streamline administrative processes, employee data management, and related activities [4]. By reducing human error, saving time, improving efficiency, and enhancing reliability and accuracy, these systems offer a significant advantage. In today's digital era, mobile-based systems are crucial for fast and accurate access, as employees expect convenience and speed in accessing information, particularly staffing applications provided by the company [5].

A Personnel Information System is designed to offer detailed insights into employee data [6]. This system provides the foundation for managing employee information in a structured, effective, and planned manner [7]. Moreover, managing and delivering electronic data becomes faster with such systems. A Personnel Information System involves a structured process for collecting, storing, maintaining, retrieving, and verifying critical data related to human resources, personnel activities, and various organizational units [8]. By implementing a mobile-based personnel information system, organizations can simplify and enhance employee management, boost efficiency, and reduce errors. Therefore, a mobile-based personnel information system is an effective and relevant solution for improving HR management efficiency in organizations.

This research aims to address these challenges by designing and implementing a mobile-based personnel information system. Using the Design Thinking approach, the solution focuses on user-centric design, ensuring the system meets the specific needs of its users. This methodology also offers a structured framework for tackling complex organizational problems, making it an innovative approach in this context. The system's development and implementation showcase the potential of mobile technology to transform HR processes within large-scale enterprises. In designing the mobile-based system, the Design Thinking methodology is applied to ensure that the resulting system aligns with user needs. Design Thinking is a user-focused approach that aids in redefining problems, generating ideas through brainstorming, and experimenting with various concepts and prototypes [9].

2. METHODOLOGY

This research employs the Design Thinking methodology as the primary approach for designing a mobile-based staffing system. Design Thinking is an iterative process that aims to understand users, define problems in depth, and identify solutions that meet their needs [10]. This method incorporates analysis, practical expertise, and innovative thinking to generate creative solutions [11]. The outcome of Design Thinking provides valuable insights and long-term benefits for users. As such, it plays a crucial strategic role in decision-making [12]. Design Thinking consists of five stages: empathize, define, ideate, prototype, and test.

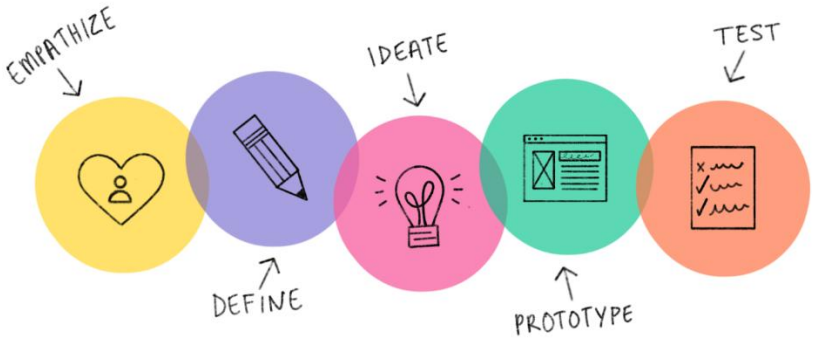

Figure 1. Design Thinking

1. Empathize

The first stage of the Design Thinking process is called empathize. The goal of this stage is to identify and observe the problems users face [13]. In this phase, it is essential to understand the context and conditions, including issues, needs, desires, behaviors, limitations, and aspirations. The empathize phase involves three steps: Observe, Engage, and Immerse [14]. User interviews and on-site observations were conducted with employees to identify pain points and workflows. Tools such as empathy maps were used to visualize user needs. Through these interviews and observations, designers gained insights into challenges users frequently encounter, such as the slow process of leave applications, difficulties in accessing attendance data, and a lack of transparency in employee data management. Understanding users' perspectives allowed designers to develop solutions that were more relevant and aligned with real-world needs.

2. Define

The define stage involves understanding and analyzing the insights gathered during the empathize phase. This process begins after identifying the problem in the previous stage, where the primary issue is defined [15]. Once the problem is clearly defined, further analysis is conducted to pinpoint the root cause, placing the user at the center of the issue. After identifying the main problem, the user interface design can be refined to address the issue effectively. User personas, which include profiles of operational employees working in remote locations with limited internet access and HR staff requiring integrated and easily accessible employee data, are created. These personas help designers analyze specific user needs, such as ease of applying for leave, transparency of attendance data, and mobile accessibility to employee information.

3. Ideate

Ideate is the stage where ideas and solutions are developed based on the problem statement defined earlier. At this stage, designers generate creative ideas using various brainstorming techniques [16]. They also consider user perspectives or alternative viewpoints. The features under consideration include an easy registration and login process, a home page that summarizes critical information such as attendance and leave status, and leave and absence management integrated with geolocation for easy submission and approval. Additionally, designers created an employee dashboard displaying personal data and attendance history, along with a notification system to remind users of their leave or attendance statuses. The user profile feature was also designed to allow employees to manage their personal information easily. These features were designed to provide convenient access and enhance efficiency, particularly for employees in remote locations or those with limited internet access.

4. Prototype

The prototype stage involves designing a prototype based on the proposed solutions, which is then translated into a user interface design [17]. The aim of this phase is to identify the best solution for each issue discovered in the first three stages [18]. A mobile application prototype was created using Figma, with a focus on an intuitive UI/UX design. Key features included an attendance tracker, leave request system, and notification dashboard.

5. Test

The testing phase is conducted to gather user feedback on the various designs created during the prototyping process [19]. Usability testing was performed with 5 employees, yielding a System Usability Scale (SUS) score of 78, indicating high user satisfaction. Feedback from this phase was used for iterative improvements in the design.

3. RESULTS AND DISCUSSION

The results of this research, based on the findings from employees or users of the Personnel Application, which were gathered during the methodological stages outlined above, are as follows.

1. Results of the Empathy Stage

At the Empathize stage, designers focused on understanding user problems directly by collecting data through interviews, questionnaires, and observations. This data collection aimed to gain deeper insights into user problems that could not be identified through other sources. The key issues identified during this stage are:

a. Unintegrated Employee Data Access
   Since all processes were still manual, employees faced difficulties accessing personal data, such as leave requests, independently.
b. Slow Administration Process

The reliance on physical documents for administrative tasks led to delays in processing leave applications, overtime requests, and data changes, which ultimately hindered work efficiency.

c. Lack of Clarity
Employees expressed confusion regarding attendance, overtime, and leave policies, resulting in difficulty accessing and understanding their rights.

2. Results of the Define Stage

At the Define stage, the issues identified through interviews and observations were analyzed to pinpoint the primary problems in employee management. The major challenge was that the existing system was entirely manual, which made it difficult to access attendance, overtime, and leave-related information. Additionally, administrative processes were slow and inefficient, occasionally leading to errors in data recording. Employees also voiced dissatisfaction due to a lack of clarity regarding policies on attendance and leave. Further observations revealed that many employees struggled with accessing personal data, applying for administrative tasks, and obtaining clear policy transparency.

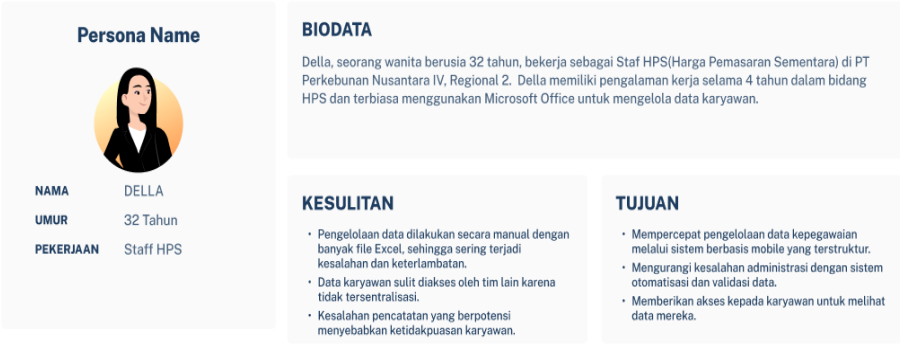

Figure 2. User Persona

3. Results of the Ideate Stage

In the Ideate stage, several solution ideas were generated based on the identified problems. These solutions were then evaluated through a brainstorming process to determine which ideas would be implemented in the user interface (UI) design. The selected solutions were translated into a UI design aimed at improving the user experience. The table below shows the solution ideas implemented in the interface design.

Table 1. Solution Ideas

No	Idea/Solution	Implementation
1	Create a Sign Up feature	A simple and user-friendly registration form with data validation for new employees.
2	Provide a Sign In feature	Secure authentication (e.g., OTP or two-factor authentication) for secure login.
3	Provide a Home page	Dashboard displaying attendance, leave, and overtime notifications.
4	Provide a Profile feature	Profile page allowing data editing and integration with HR data.
5	Create an Attendance Record feature	Geo-location-based attendance system for accurate clocking in.
6	Provide an Attendance History feature	Displays a complete history of attendance, including clock-in and clock-out times.
7	Provide Leave and Overtime features	Real-time submission and approval status for leave and overtime requests.
8	Create a Report feature	Automated attendance, leave, and overtime reports, with export options (PDF, Excel).

The brainstorming process involved employees, the system's primary users, who provided valuable insights into what they needed, such as easy access to information and transparency in leave requests. Feedback also highlighted the importance of features like attendance history and automated reports for administrative efficiency.

Solution ideas were prioritized based on their relevance to employees' most common issues, such as difficulty accessing attendance data and slow administrative processes. The selected solutions were translated into a user interface design that prioritized simplicity, intuitiveness, and ease of use.

4. Results of the Prototype Stage

For the Prototype stage, the Figma tool was used due to its ease of use and comprehensive documentation. At this stage, the design of the personnel information system was finalized based on the identified functionality. Potential users and partners were invited to provide feedback on the design to ensure it met their needs.

a. User Flow
There are 4 User Flow or processes that occur in the designed employee information system.

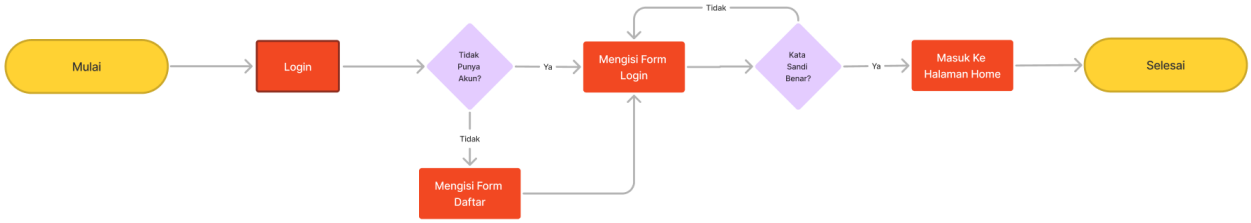

Figure 3. User Flow Login and Register

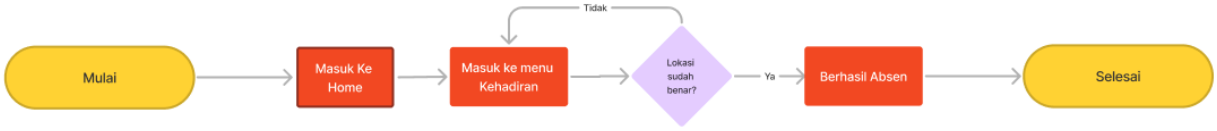

Figure 4. Attendance User Flow

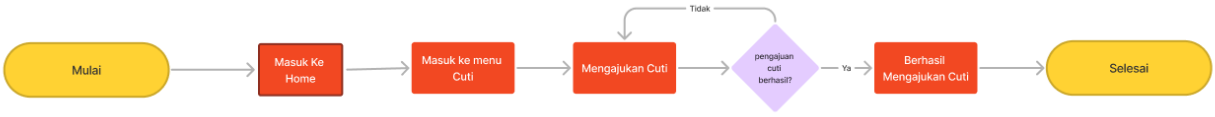

Figure 5. User Flow of Leave Application

Figure 6. User Flow for Overtime Submission

b. High Fidelity Prototype
Sign Up and Sign In
Users with access can log in with their email and password. New users can register by filling out required fields, and their account is created with the provided email. The password is processed automatically.

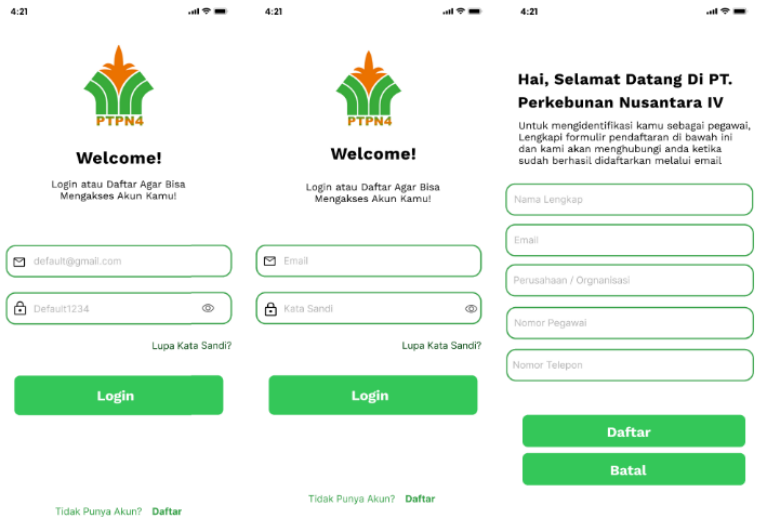

Figure 7. Sign In and Sign Up

Home

The Home menu features tailored information for users, including attendance, overtime, and leave menus. The attendance section is prioritized for efficiency.

Figure 8. Home

Profile

The Profile menu displays the account holder's personal information, with the option to update details. A verification feature ensures security in case of forgotten email addresses.

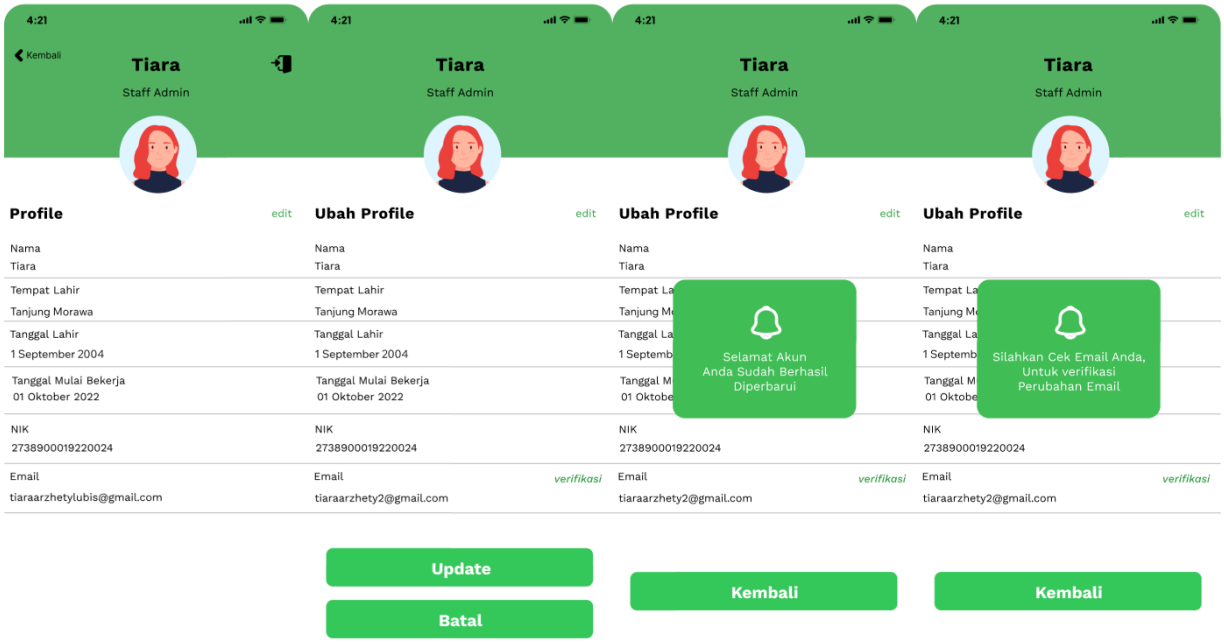

Figure 9. Profile

Attendance Record (Absence)
The Attendance menu allows users to log their attendance using a geo-location feature for accuracy. A success or failure popup appears after each clock-in attempt.

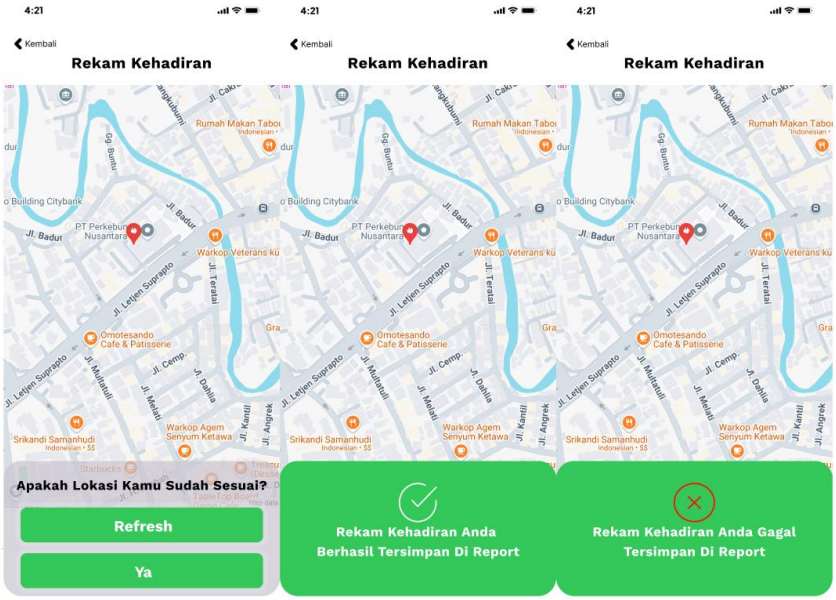

Figure 10. Attendance Record

Leave
The Leave view shows the history of leave applications and their status. Users can apply for leave by clicking "apply," and the status will appear on the leave history page.

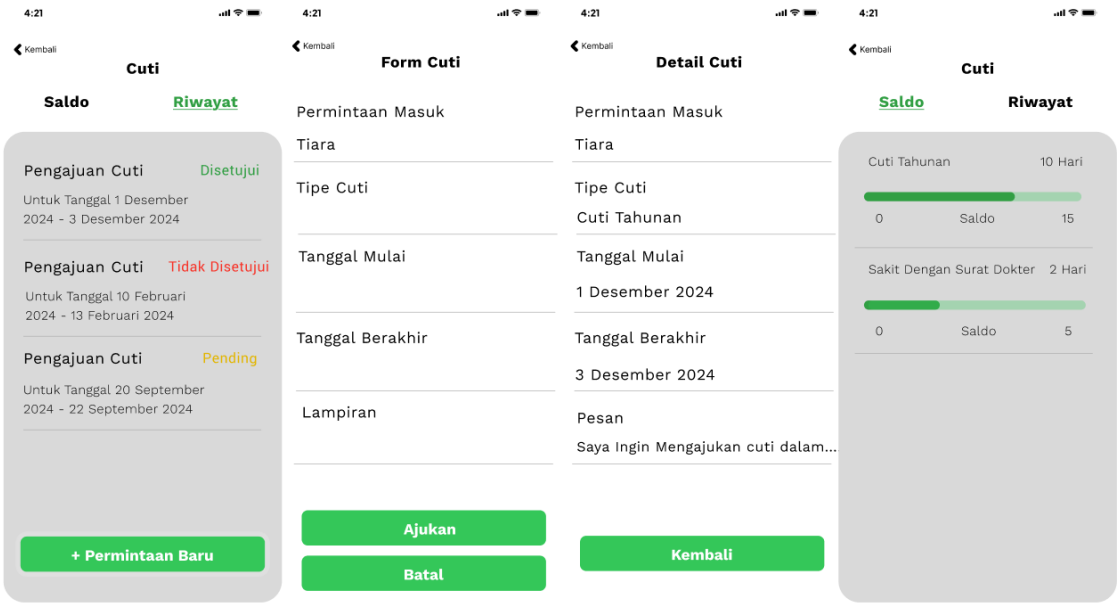

Figure 11. Leave

Overtime
The Overtime view shows the history of submitted overtime requests and their status. Users can create new overtime requests and view details once submitted.

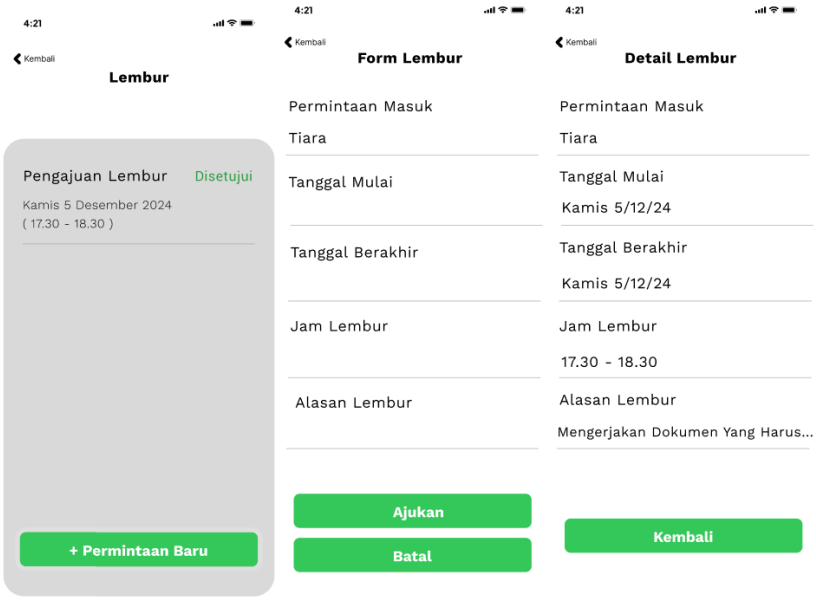

Figure 12. Overtime

Report

The Report view provides access to attendance, leave, and overtime reports. Users can filter reports by date and download them in Excel format or send them via email.

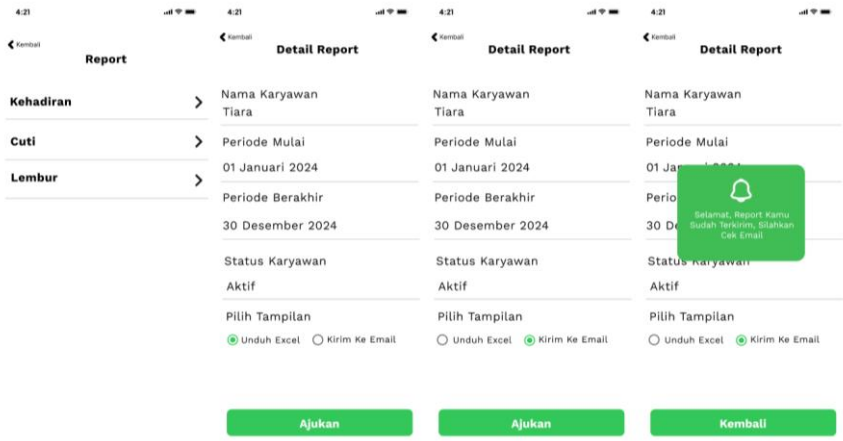

Figure 13. Report

5. Testing

The final stage of Design Thinking is testing, where usability testing or user experience testing is conducted to evaluate the flow and user experience with the developed application. This helps identify any obstacles or difficulties users face in using the application [20]. The System Usability Scale (SUS) was employed to measure the ease of use and user satisfaction based on subjective user views. SUS was developed by John Brooke in 1986 [7].

After collecting the questionnaire results, calculations were performed using Microsoft Excel. For odd-numbered statements, the score was reduced by 1 (X-1), and for even-numbered statements, the score was subtracted from 5 (5-X). The raw SUS scores were then calculated. The final SUS score was determined by multiplying the raw score by 2.5.

Table 2. SUS Final Calculation Value

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total	Score (Total x 2.5)
4	4	4	4	3	4	4	3	4	3	38	95
4	2	4	2	4	2	4	2	2	2	28	70
3	3	3	3	3	3	3	3	3	3	28	70
4	2	2	2	2	3	3	3	2	3	31	78
3	3	3	3	3	3	3	3	3	3	30	75
Average Score (Final Result)											78

The final step was calculating the average score by summing all SUS scores and dividing by the number of respondents. The resulting average score was 78.00, which falls within the "Good" category (B).

The primary objective of this research was to develop a mobile-based personnel system that improves administrative efficiency and provides a transparent, user-friendly experience for employees. The SUS score of 78.00 reflects the system's success in addressing key challenges, such as slow administrative processes, lack of clarity in policies, and difficulty accessing employee data. Features like automated leave requests, attendance tracking, and personal data management were particularly appreciated by users during testing.

The Design Thinking methodology was crucial in achieving these goals. By continuously focusing on user needs and incorporating feedback throughout the process, the methodology ensured the system was both functional and intuitive. The iterative process of prototyping, testing, and refining based on real user input led to high user satisfaction.

However, the methodology has limitations, especially when it comes to generalizing results. Testing was conducted with a small sample of users, which may not fully represent the experiences of a larger, more diverse group of employees. Additionally, the time constraints of the study limited the scope of testing, and further research with a larger sample size and more diverse user base could offer deeper insights into the system's effectiveness across different contexts.

4. CONCLUSION

The research concludes that a mobile-based employee information system, developed using the Design Thinking methodology, significantly enhances data management efficiency at PT Perkebunan Nusantara IV. Through the five stages of empathize, define, ideate, prototype, and test, the system was designed to address user needs, incorporating features such as location-based attendance, transparent leave and overtime requests, employee profile management, and real-time attendance reporting. This system effectively resolves key challenges, including slow manual processes, limited data access, and lack of transparency, while boosting operational efficiency and providing accurate data for decision-making.

However, the research and system have several limitations. One major limitation is the system’s dependence on internet access, which may affect its functionality in areas with poor network coverage. Additionally, the user testing was limited to a small sample size, which may not fully reflect the needs of a larger, more diverse workforce. The system also focused primarily on attendance, leave, and employee profile management, leaving other HR functions, such as payroll management and performance evaluations, outside its scope.

To further improve the system, future research could consider integrating predictive analytics to optimize workforce management, such as forecasting staffing requirements and refining shift schedules based on attendance data. Expanding the system to include payroll management and performance evaluations would also provide a more comprehensive solution for managing employee data. These enhancements would increase the system’s robustness, enabling it to support a wider range of HR functions and further improving organizational efficiency.

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