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Architecting and Implementing a Web-Based Payroll System for Enhanced Human Resource Management: A Case Study of PT. Bangun Jaya Power

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Abstract

This study develops a website payroll information system using the waterfall method. In its development, PT. Bangun Jaya Power became a partner in this study. PT. Bangun Jaya Power is a company engaged in the field of labor supply and parking service management. This company has more than dozens of workers who are members as permanent employees or outsourcing. This system innovation is to facilitate and create an optimal system in assisting the employee payroll process through an organized and sophisticated digital system so that the payroll process runs optimally and minimizes errors. With the SDLC (System Development Life Cycle) development method, computer-based applications are needed to automate interactions between internal parts, namely with a web-based payroll application.

Keywords– *Waterfall, Website, System Development Life Cycle, Payroll*

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1. Introduction

The rapid advancement of information technology has brought about significant changes across various sectors, particularly in the business world. In this digital era, the speed and accuracy of data management are critical for a company's operational efficiency. Traditional manual systems often face numerous challenges, such as time inefficiencies, data errors caused by human mistakes, and difficulties in generating comprehensive reports. These issues can hinder a company's optimal performance and delay management's decision-making process (Pratama, 2023).

PT. Bangun Jaya Power, a company specializing in providing security and parking services, continues to manage its payroll using a manual system. This process involves calculating salaries based on fundamental components, including basic pay (based on job position), overtime wages, health insurance deductions, holiday allowances, and tax withholdings (PPh 21) (Lubis, 2021). The company’s manual payroll process, despite being time-consuming, has led to a number of operational inefficiencies.

The company's reliance on manual record-keeping and a lack of integrated applications has resulted in disorganized data, slowing down the payroll calculation and distribution processes. This manual approach frequently leads to calculation errors, which negatively impacts employee satisfaction and administrative efficiency (Nayla et al., 2025). Given that the company operates in the outsourced labor sector, managing a large number of both internal and external employees across various client sites further complicates the payroll process. A more centralized and automated solution is urgently needed to address these challenges.

To overcome these issues, this study proposes the design and implementation of a web-based payroll information system. This system offers a strategic and relevant solution by integrating all employee payroll data and calculations into a centralized platform. The proposed system is expected to not only enhance data accuracy but also significantly increase efficiency in data

processing and salary distribution. By providing remote access, the system aims to streamline administrative tasks and improve overall productivity within the company (Muliadi et al., 2020).

2. Method

In this study, the authors employed the SDLC research methodology. The Waterfall Model is a well-established and widely used software development methodology within the Software Development Life Cycle (SDLC). The SDLC is a structured framework that outlines the process of developing, maintaining, and enhancing software systems. According to Sukamto and Shalahuddin (2013), the SDLC leverages proven models and methodologies based on best practices to ensure a systematic and effective development process.

The Waterfall Model, often referred to as the linear-sequential model or classic life cycle model, is characterized by its sequential and orderly flow of stages. Each phase must be completed before the next one can begin, without any overlap (Firmansyah & Udi, 2018). The primary stages of this model include:

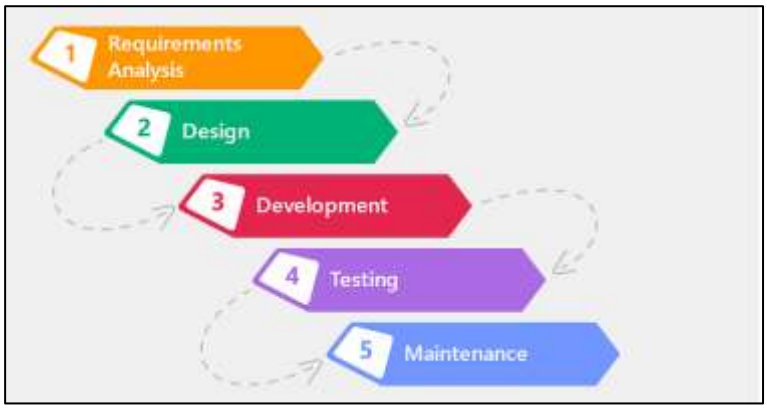

Figure 1. Software Development Life Cycle Method

Source : Dimas Rizky (Rizky, 2019)

a. Requirements Analysis. Requirement Analysis is a critical step in the software development lifecycle, aiming to define the system's specifications. This study employed a multi-faceted approach to gather comprehensive data,

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starting with interviews, observations, and literature reviews. Interviews were conducted with key personnel to understand existing manual processes and identify pain points. This was followed by direct observations to validate the gathered information and document the actual workflows. A literature review was also performed to establish a theoretical foundation and identify best practices in payroll information system development, ensuring the proposed solution would align with modern software engineering principles (Muttaqin et al., 2025).

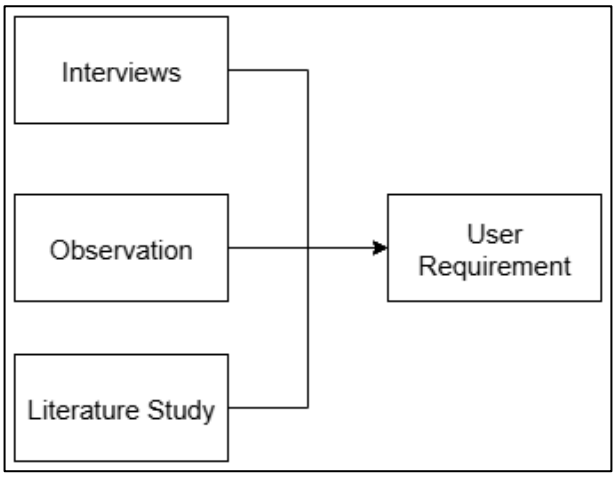

Figure 2. Requirement Analysis Flow

The synthesis of data from these methods culminated in a detailed user requirement analysis. This analysis systematically documented user stories, functional requirements (e.g., automated salary calculation and report generation), and non-functional requirements (e.g., security and performance) for three distinct user roles: Admin, Accountant, and Employee. This structured approach created a clear blueprint for the system's design and development, mitigating the risk of miscommunication and ensuring the final system would be both effective and well-aligned with the organization's needs (Firdaus et al., 2025).

Table 1. User Requirement

Role	Tasks
Admin	1. Manage job position data 2. Manage employee data 3. Manage nominal data 4. Manage insurance data

Role	Tasks
	5. Manage insurance detail data 6. Manage income tax (PPh) data 7. Manage allowance data 8. Manage allowance detail data 9. Manage salary data 10. Approve debt requests 11. Manage attendance data 12. Manage debt approval data 13. Manage debt repayment data 14. Generate overtime reports 15. Generate attendance reports
Employee	1. Submit debt requests 2. View salary data
Accountant	1. Approve salary payments 2. Generate PPh 21 reports 3. Generate health insurance reports 4. Generate salary reports

b. System Design. System Design is a crucial phase in the Software Development Life Cycle (SDLC) that focuses on creating a comprehensive blueprint for the software's architecture after all requirements have been analyzed. During this stage, developers decide how the system will function, including the database structure, software architecture (e.g., client-server or microservices), the individual modules to be built, the interfaces between these modules, and the necessary hardware and software specifications. The main goal is to produce a detailed and clear plan that will guide the development team during the subsequent implementation or coding phase (Praditha et al., 2024). Here is the system design for this study.

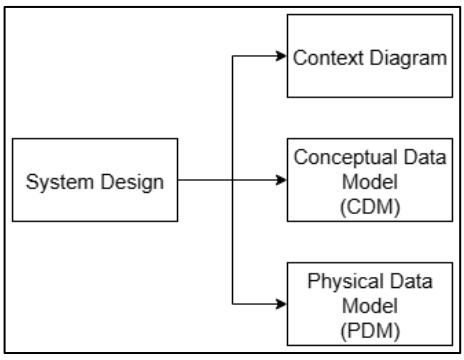

Figure 3. System Design Flow

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The Context Diagram for the proposed web-based payroll information system illustrates the high-level interactions between the system and its external entities. This system has four external entities that provide input and receive output: HR Admin, Cashier, Employee, and Accountant (Romansa et al., 2024). The comprehensive context diagram for the web-based employee payroll information system is presented in image below.

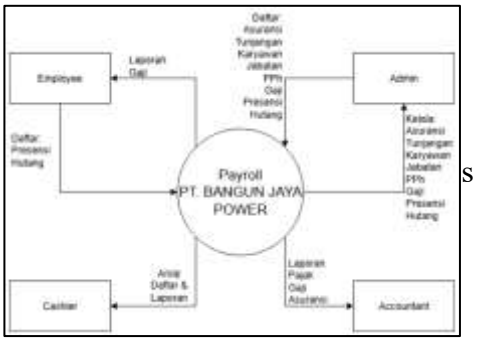

Figure 4. Context Diagram

Conceptual Data Model (CDM) is a high-level, technology-independent representation of the data and its relationships within a system. It serves as a foundational blueprint that defines the essential business entities, their attributes, and the relationships between them, without specifying how the data will be physically stored or implemented. The primary purpose of the CDM is to provide a clear and shared understanding of the data structure from a business perspective, ensuring all stakeholders have a common view of the information being managed by the system. This model is crucial for the early stages of system design, as it captures the core data requirements and lays the groundwork for the more detailed Logical Data Model (LDM) and Physical Data Model (PDM) that follow (Fischer et al., 2018).

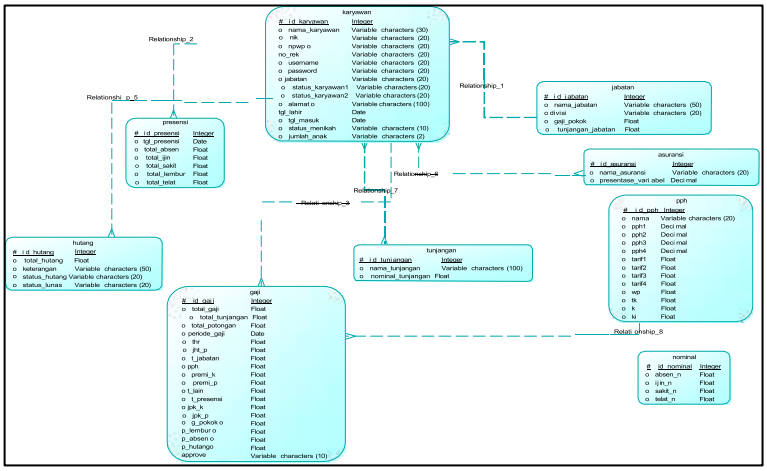

Figure 5. Conceptual Data Model

Physical Data Model (PDM) is a technology-specific, detailed representation of the database structure, which is derived from the logical data model. Unlike the conceptual and logical models that focus on business rules and data relationships, the PDM specifies exactly how the data will be implemented and stored in a particular database management system (DBMS). It includes all the necessary components for creating the database, such as table names, column names with their precise data types (e.g., VARCHAR, INT), primary and foreign keys to enforce relationships, indexes for performance optimization, and other physical constraints. The PDM serves as the final blueprint for database administrators to build and deploy the actual database, ensuring the system's data is stored efficiently and adheres to the technical requirements of the chosen database platform (de Jong et al., 2016).

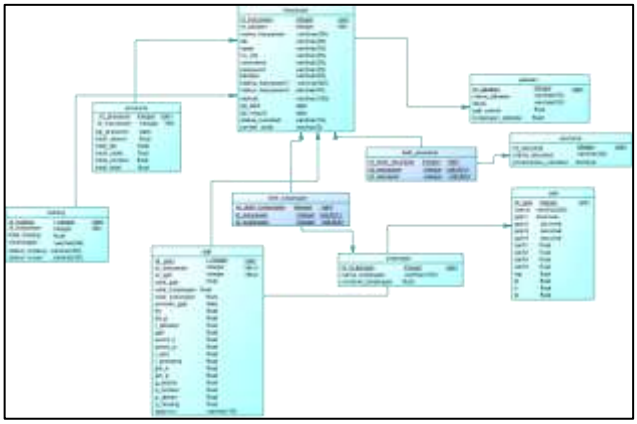

Figure 6. Physical Data Model

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c. Development. The Development/Implementation phase is a pivotal stage in the Waterfall SDLC, where the system's design specifications are translated into a tangible, functional product. This phase strictly follows the completion of the system design, and it is guided by the detailed blueprints, architectural designs, and data models created in the preceding stages. The core activities include coding the software based on the specified functional and non-functional requirements, developing the database schema as defined in the Physical Data Model, and integrating various software components. During this stage, developers also perform unit testing to verify that each individual module operates correctly and meets its specific design criteria. The successful completion of this phase results in a fully developed and integrated system ready for the subsequent testing and verification phase.

d. Testing. Within the Waterfall SDLC, Integration Testing is a crucial stage that immediately follows the development and unit testing of individual software modules. The primary objective of this phase is to systematically verify that these independently developed modules function correctly when combined and interact with one another. This process involves assembling the modules and testing the interfaces and data flow between them to ensure seamless communication and data exchange. Unlike unit testing, which focuses on the internal logic of a single component, integration testing is specifically designed to uncover defects that arise from the interaction between modules, such as incorrect data formatting, inconsistent parameters, or logical errors in communication protocols. The successful completion of this phase ensures the cohesion of the system's components, providing a solid foundation for subsequent system-wide testing.

e. Maintenance. The Maintenance/Operation phase is the final and often most extensive stage of the Waterfall model, which begins after the fully developed and tested software has been deployed and is in active use. This phase is dedicated to ensuring the long-term viability and performance of the system. The activities within this stage encompass various forms of maintenance, including corrective maintenance to fix defects and errors that were not

discovered during earlier testing phases, and adaptive maintenance to modify the software in response to changes in the external environment, such as new operating systems or hardware. Additionally, perfective maintenance is performed to enhance system functionality and improve overall performance based on user feedback or evolving business needs. This ongoing process is crucial for sustaining the software's value, relevance, and operational integrity throughout its life cycle.

3. Result and Discussion

This chapter presents the outcomes of the web-based payroll information system developed for PT. Bangun Jaya Power. The primary objective of this system was to streamline and automate administrative processes, thereby enhancing the company's operational efficiency. The following sections will detail the key functionalities of the system through a series of visual representations. These interfaces demonstrate the successful implementation of the system's core features, which have been designed to meet the specific user requirements identified in the previous analysis phase. The presented screenshots and descriptions illustrate how the system simplifies tasks, from managing employee data to generating automated payroll reports.

Login Page

Figure 7. presents the user login interface, which serves as the primary gateway to the web-based payroll system. This interface is designed to ensure secure user authentication and data confidentiality. Users are required to input their unique Employee Identification Number (NIK) and a corresponding password to access the system. This authentication process is fundamental to the system's security protocol, as it verifies the identity of each user before granting access to specific functionalities based on their assigned role (Admin, Accountant, or Employee). The interface also includes a "Sign me in" button to initiate the authentication process. The inclusion of a "Sign up" link, while present, is typically intended for new employee registration processes managed

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by the system administrator, reflecting the controlled environment of a corporate payroll system.

Figure 7. Login Page

Register Page

Figure 8. displays the user registration interface for the payroll system, which is used for creating new user accounts. This interface is a critical component of the system's administrative and security architecture, particularly in a controlled environment like a corporate setting. To create an account, the user must provide a unique Employee Identification Number (NIK) and a new password. The "Sign me up" button initiates the account creation process, which typically requires administrative approval or is performed directly by the HR Admin to maintain centralized control over user access. The interface also includes a link to the "Sign in" page for users who have already registered, ensuring smooth navigation within the system. This registration process is essential for ensuring that each employee is assigned a secure, unique set of credentials before accessing their respective functionalities within the system.

Figure 8. Register Page

Main Dashboard

Figure 9. displays the system's dashboard, which serves as the main home screen upon successful login. The dashboard provides a high-level overview and structured navigation for the user. On the left side, a navigation menu is clearly divided into two main categories: Master and Transaction.

The Master section contains links for managing core data entities such as Insurance, Allowances, Employees, Job Positions, and PPh (Tax), which are fundamental components for payroll calculation. The Transaction section provides access to day-to-day operational functions, including Salary, Attendance, and Loans.

In the center of the screen, a welcome message confirms that the user has successfully logged into the "PAYROLL PROGRAM PT BANGUN JAYA POWER." The top-right corner of the interface displays the name of the currently logged-in user (Djuanda), indicating that the system has correctly authenticated and identified the user. This dashboard design ensures organized and efficient access to all system features.

Figure 9. Main Dashboard

Karyawan Page

Figure 10 illustrates the interface for managing employee master data, a fundamental component of the payroll system. Titled "LIST KARYAWAN PT BANGUN JAYA POWER," this page provides a centralized and comprehensive view of all employee records. The interface displays a table with key employee details, including their unique Employee Identification Number (NIK), name, and job position. To support administrative tasks, the page is equipped with features for searching, sorting, and pagination, which are

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essential for navigating a large number of entries efficiently. The presence of the "TAMBAH DATA" (Add Data), "EDIT," and "DELETE" buttons demonstrates that the system provides full CRUD (Create, Read, Update, Delete) capabilities. This robust data management module is critical for maintaining the accuracy and integrity of the core employee information, which serves as the foundation for all subsequent payroll calculations and reporting.

Figure 10. Karyawan Page

Karyawan Form

Figure 11 illustrates the data entry form for adding new employee records to the system. This comprehensive interface is a critical component of the employee master data management module, ensuring that all necessary information is collected in a structured format. The form is organized to capture a wide range of data points, including personal details such as Full Name, Address, Date of Birth, and Marital Status, as well as employment-specific information like Employee ID (NIK), Job Position, and Joining Date. Crucially, the form also includes fields for financial data, such as NPWP (Tax ID) and Bank Account Number, and for system administration, specifically Application Access Rights, which allows the administrator to assign a user role to the new employee. The form is completed with "Submit" and "Cancel" buttons, enabling the administrator to finalize or discard the data entry. This structured data collection is vital for populating the system's database with accurate and complete information, which is fundamental for the integrity and functionality of the entire payroll system.

Figure 11. Karyawan Form

Gaji Form

Figure 12. displays the salary data entry form, which is a central component of the system's transaction module. This interface is designed to facilitate the manual input and calculation of an employee's salary for a specific Salary Period. The form is structured to be comprehensive, accommodating all relevant payroll components. Key fields include employee identification details, such as NIK and Employee Name, which can be retrieved efficiently using the "Cari Karyawan" (Search Employee) button. The form categorizes input fields into earnings and deductions, including Basic Salary, Job Allowances, Overtime Pay, and Holiday Allowances (THR), as well as deductions for Income Tax (PPh), Absence, and Loans. It also provides separate fields for both employee-paid and company-paid health insurance premiums, ensuring a detailed and accurate calculation. This interface directly addresses the inefficiencies of the manual process by providing a structured and organized environment for entering all variables required for a complete salary computation.

Figure 12. Gaji Form

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Absence Form

Figure 13. displays the attendance data entry form, a vital component of the system's transaction module. This interface is designed to centralize and streamline the process of recording employee attendance for a specific date. The form allows administrators to easily input data for a particular employee, whose details can be quickly retrieved using the "Cari Karyawan" (Search Employee) button based on their NIK. The form is structured with dedicated fields for various attendance statuses that directly impact payroll, including the number of Absent days, Leave days (Izin), Sick days, hours of Overtime, and instances of being Late. This digital interface is crucial for ensuring the accuracy and integrity of attendance records, which serve as a critical input for the automated calculation of deductions and overtime pay, thereby eliminating the manual errors and inefficiencies inherent in traditional methods.

Figure 13. Absence Form

4. Conclusion

In conclusion, this research successfully developed a web-based payroll information system using the Waterfall SDLC methodology, which proved to be a suitable framework given the project's well-defined requirements. The implemented system offers an effective solution for enhancing the efficiency and transparency of administrative processes at PT. Bangun Jaya Power. By integrating various administrative services onto a single platform, the website successfully facilitates the management of key data including employee records, salaries, insurance, taxes (PPh), and attendance among administrators, accountants, and employees. The implementation demonstrates that the system

has achieved its primary research objective of accelerating and simplifying administrative tasks. With its simple and intuitive interface, the system significantly reduces the time required for processing employee payroll.

While the system successfully meets its core objectives, further development is recommended to ensure its long-term viability and scalability. Future work should focus on enhancing data security features and conducting more extensive testing for large-scale usage in broader organizational environments. Furthermore, continuous user evaluation and feedback are necessary to ensure the system remains relevant and effective in addressing the company's evolving administrative needs.

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