


Development of employee payroll system in construction company using extreme programming method

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Article Info	ABSTRACT
<p>Keywords: Payroll System, Construction Company, Extreme Programming</p>	<p>The management of employee payroll systems in construction companies is often faced with complex challenges, including the need for response speed, salary calculation accuracy, and user acceptance. A responsive and adaptive system can help operational efficiency and employee satisfaction. This research applies the Extreme Programming (XP) method in developing an employee payroll system, focusing on functionality testing, user evaluation, and stakeholder validation. The XP method was chosen because it can provide adaptive and responsive solutions to changing business needs. The user acceptance analysis and feature testing results showed the system's success, with the accuracy of salary calculation reaching 88 % and the user interface rated intuitive by users. Performance evaluation also showed an average system response speed of less than 2 seconds, indicating optimal responsiveness. Validation with stakeholders confirmed that the system met company policies and management expectations. The application of the XP method in developing an employee payroll system in a construction company positively impacted operational efficiency and user satisfaction. The conclusions of this study underline the successful implementation of the system and highlight the potential for further development to maintain the responsiveness and quality of the system over time.</p>
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INTRODUCTION

The construction industry plays a crucial role in the global economy as a significant driver of economic growth and job creation. Construction activities involve various (Alzahrani & Emsley, 2013; Boateng et al., 2022; Fredriksson & Hüge-Brodin, 2022; Ingle & Mahesh, 2022) infrastructure, residential, and commercial projects that support the development of a country. With the involvement of this sector, there is a positive impact on related sectors, such as manufacturing, transport, and services. The role of construction in the economy is not only limited to physical development but also as a catalyst for economic growth. As a job provider, the construction industry contributes to the unemployment rate and national income. In addition, construction projects can strengthen infrastructure that supports other sectors, improve the country's competitiveness, and create investment opportunities (Celik et al., 2023; Choi & Ha, 2022; Gao, 2022; Xu et al., 2022; Zhang et al., 2022).

The construction industry faces dynamic challenges, such as fluctuating material prices, changing regulations, and high levels of competition. These dynamics demand constant adaptation and innovation to stay relevant and efficient. Construction companies must be able to navigate resource uncertainty and overcome logistical obstacles that can affect project schedules. The complexity of construction companies often follows the growth of the construction industry. These companies evolve into entities that involve various aspects, including project management, procurement, and administration. Therefore, effective operational and administrative management is crucial to success (Khodabakhshian & Re Cecconi, 2022; Pham et al., 2023; Sihombing, 2023; Tessema et al., 2022).

The employee payroll system of a construction company plays an essential role in ensuring that workers are adequately rewarded for their contributions. This process involves calculating salaries, benefits, and incentives based on performance and employment contracts. Good payroll management is critical to maintaining employee satisfaction and retention. The importance of effective payroll is not only limited to the financial aspect but also impacts employee motivation and performance. Fair and timely pay creates a stable working environment, increases productivity, and creates employee loyalty (Aliev et al., 2020).

The complexity of employee payroll in construction companies includes various components, including base salary, special allowances, and performance bonuses. The process is further complicated by changing tax and labor laws, which require careful management to avoid inaccuracies and legal complications. Employee salary management faces various challenges, including payroll delays, complex salary calculations, and adjustments to new regulations. These challenges require a responsive and efficient system to address administrative issues and ensure compliance with legal requirements. Conventional employee payroll systems often need help with problems such as delays and inaccuracies in payroll. Difficulties adjusting to changes in tax and legal policies and managing additional payments such as bonuses and incentives can also lead to inefficiencies. Delays and inaccuracies in the payroll process are significant issues that can affect employees' financial stability. Delays can create uncertainty and reduce motivation, while inaccuracies can lead to dissatisfaction and potential conflict (Aliev et al., 2020; H. C. Chen, 2019; Gao, 2022; H. Wang et al., 2023).

The importance of developing a responsive payroll system is reflected in its ability to adjust to changing business needs. A responsive system can provide the speed and flexibility needed to address industry dynamics and maintain employee satisfaction. Competitive factors in the construction industry put pressure on companies to improve employee productivity. Productive employees produce work efficiently and contribute to the company's competitive advantage. Skills, motivation, and a conducive work environment are critical factors in achieving high productivity and creating a solid competitive edge in the market (Aliev et al., 2020; Li et al., 2019; Sambodo et al., 2023; X. Wang & Wang, 2022).

The implementation of an effective and fair payroll system has a positive impact on employee satisfaction and retention. Employees who feel valued and compensated commensurate with their contributions are more satisfied with their jobs. High satisfaction levels can increase employee retention, reduce turnover, and create a stable work environment. The Extreme Programming (XP) method is a software development approach emphasizing collaboration, flexibility, and responsiveness to change. In the context of developing an employee payroll system in a construction company, the use of XP can bring significant benefits. Collaboration between teams, feature-based development, and continuous testing can result in an adaptive system suited to changing business needs (Al-Saqqa et al., 2020; Dingsoeyr et al., 2019; Dingsøyr et al., 2012; Santos et al., n.d.; Serrador & Pinto, 2015).

The basic principles of Extreme Programming (XP) include intensive communication, rapid feedback, and flexibility in responding to change (Akhtar et al., n.d.; J. Chen et al., 2020). This approach encourages practices such as pair programming and automated testing, which aim to improve software quality and development speed. These principles provide the foundation for creating an adaptive and efficient payroll system. The Extreme Programming (XP) method has several advantages, including responding quickly to change, feature-based development, and focusing on code quality (Batliner et al., 2022; Beecham et al., 2021; Gutierrez et al., 2019; Martin, 2023; Persson et al., 2022). However, like every development method, XP also has disadvantages, such as requiring a high level of involvement from the team, and some organizations may need help in applying its principles. It is essential to consider both these advantages and disadvantages when developing an employee payroll system. The successful implementation of Extreme Programming (XP) in a business context, particularly in developing an employee payroll system, depends on several factors. Effective team collaboration, commitment to XP principles, and adaptability to business change are crucial to success. Continuous and retrospective evaluation can help identify necessary improvements and ensure that XP implementation adds value to the construction company.

METHODS

The research followed three main stages, as shown in Figure 1, starting with data collection that involved identifying business needs, surveys, interviews, and literature studies to understand the employee payroll system of a construction company thoroughly. Next, the application development stage includes project planning, system design, feature implementation, and continuous integration to create a responsive and efficient solution. Finally, the user acceptance analysis stage involves functionality testing, user trials, performance evaluation, and validation with stakeholders to measure the acceptance level of the employee payroll system. By bringing these three stages together, this research aims to produce a solution that meets technical and functional needs and is well accepted by users in a construction company environment.

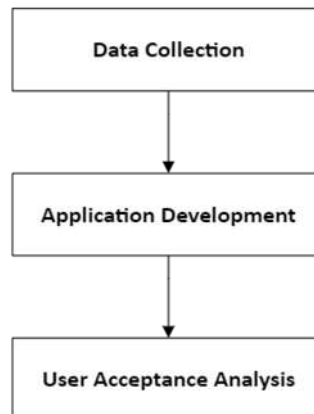


Figure 1. Research Methods

Data Collection

In the data collection phase, the research started with identifying business needs related to the employee payroll system in a construction company. Surveys and intensive interviews were conducted with stakeholders, including management, HR, and employees, to gain in-depth insights into their expectations and needs for the payroll system. In addition, a literature study was conducted to detail relevant frameworks and best practices. This stage provided a solid foundation for designing and developing a suitable solution.

Application Development

The following process is application development, starting with project planning, which includes estimating time, resources, and development schedules. The team takes concrete steps such as designing the system architecture, implementing key features such as salary calculation, and applying pair programming practices. Continuous integration is applied periodically to ensure code changes are efficiently integrated into the system.

User Acceptance Analysis

After development, the focus shifted to the user acceptance analysis stage. The team conducted functionality testing and involved users in trials, collecting feedback on the user interface and ease of use. Performance evaluations were conducted to measure the app's responsiveness and capacity. Validation with stakeholders, such as management and HR, was necessary before the user acceptance analysis. By analyzing the test results and user feedback, the research evaluated the extent to which the employee payroll system was adopted and accepted in a construction company environment.

RESULTS AND DISCUSSION

Results of Data Collection

In the data collection phase results, the research successfully identified the deep business needs related to the employee payroll system in a construction company. Through surveys, intensive stakeholder interviews, and literature studies, rich information was obtained from management, HR, and employees, revealing deep insights into their expectations and needs for the payroll system. The literature study also provided relevant frameworks and best practices, providing a solid foundation for designing and developing a suitable and

efficacious solution. The results of this stage provide a solid foundation to move to the next stage in developing a responsive and effective payroll system.

Table 1. Data Collection

Stakeholders	Category	Needs and Expectations
Management	General	Increased efficiency in salary calculation
Management	General	Integration with Human Resource management system
HR	Process	Ease of employee data management
HR	Process	Improved payroll accuracy
Employees	Wellbeing	Transparency of salary components
Employees	Welfare	Fair and transparent incentive system

Analysis of the data, as shown in Table 1, from the stakeholders in the data collection phase shows that the management of construction companies emphasized improved efficiency in salary calculation and better integration with the HR management system. These expectations indicate a drive to improve administrative processes and linkages between payroll and human resource management systems. On the other hand, the HR team highlighted the need for ease in employee data management and improved payroll accuracy, indicating the challenges that may be faced in data management and precise salary calculation. From the employee perspective, the focus on transparency in salary components and fairness in the incentive system reflects a desire to understand their compensation and support performance-based motivation better. The results of this analysis provide a strong starting point for designing and developing a responsive payroll system solution that meets the needs and expectations of each stakeholder.

Application Development

In the outcome of the Application Development stage, the project team successfully created a comprehensive project plan, including time estimation, resource allocation, and development schedule. This step provided a solid foundation for further development. Next, the system design was carried out by detailing the payroll system architecture, including aspects of its database, user interface, and business logic. Key features such as salary calculation, employee data management, and tax setting system were implemented according to plan. Pair programming improved code quality and facilitated knowledge exchange among development team members. Continuous integration was implemented periodically to ensure that any code changes were integrated smoothly and that the application was always working. The outcome of this stage created a solid technical foundation for a responsive and efficient payroll system application.

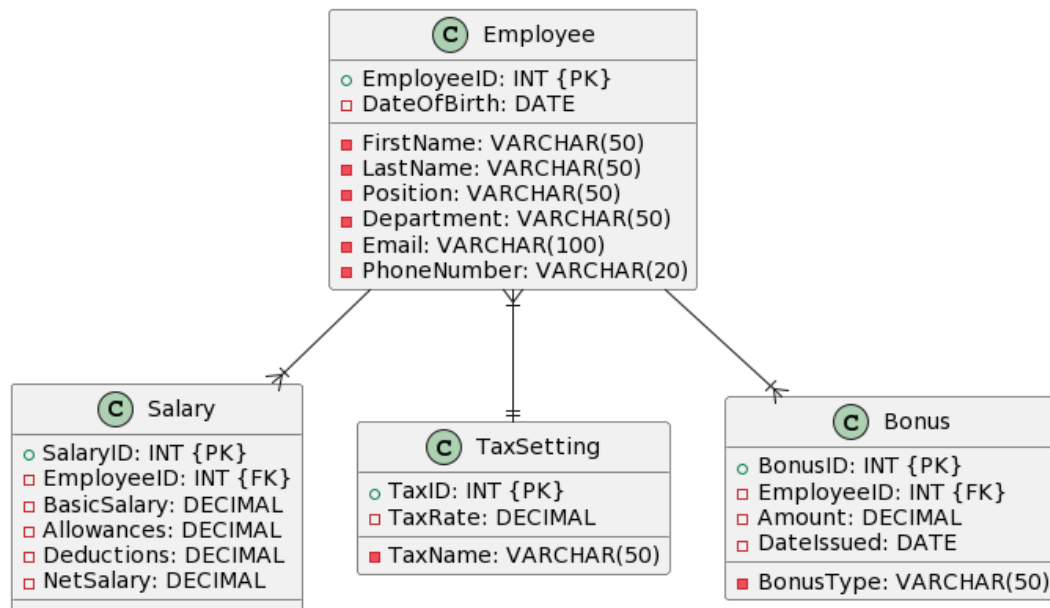


Figure 1. ER-Diagram

The ERD in Figure 2 reflects the organized data structure for an employee payroll system in a construction company. The Employee entity represents employee information, including personal details, and EmployeeID is the primary key. The one-to-many relationship between Employee and Salary allows the recording of multiple salaries for each Employee, including components such as base salary, allowances, deductions, and net salary. TaxSetting, with a many-to-one relationship to Employee, stores tax configurations that can apply to multiple employees. The Bonus entity, with a one-to-many relationship with employees, provides the flexibility to record different employee bonuses. Thus, the ERD provides a comprehensive picture of how employee payroll-related data is organized and interrelated in a construction company environment. This analysis provides the foundation for designing and implementing an efficient and responsive payroll system.

The result of this research is that the State diagram that has been created reflects the workflow and status transition of employees in the context of the payroll system. The diagram starts with the "Idle" state, indicating that the Employee is inactive. When employees log in, they transition to the "Active" state, signaling their activeness in the system. Employees can start working from here and enter the "Working" state. Upon completion of work, they can return to the "Idle" status by logging out.

Additionally, employees can apply for leave from the "Active" state, switching to the "OnLeave" state. After the leave, they can return to the "Idle" status. However, if employees decide to resign during their leave, they can switch to the "Resign" status. After confirmation of resignation, they return to the "Idle" status.

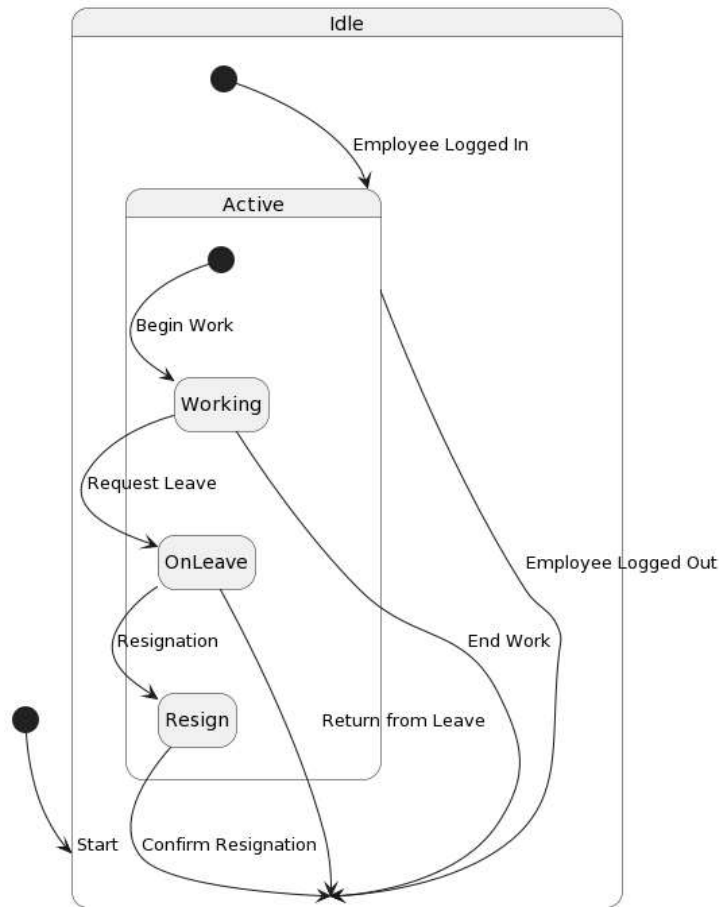


Figure 2. State Diagram

The state diagram in Figure 3, provides a visual representation of the employee lifecycle in the payroll system, highlighting the relevant transitions between states. This helps in understanding and designing efficient and responsive workflows for employees in the context of payroll management.

In Table 2, the application features highlight the critical aspects integrated into the employee payroll system of a construction company. Accurate salary calculation and employee data management systems provide the basis for administrative efficiency. The tax management system and integration with the human resource management system ensure regulatory compliance and coherence between different aspects of the organization.

Table 2. Features of Application

App Features	Description
Salary Calculation	This feature allows the system to calculate employee salaries based on specified parameters.
Employee Data Management	Provide functionality to enter, edit, and manage employee data.
Tax Setting System	Enables tax configuration and management by applicable regulations.

App Features	Description
Intuitive User Interface	Provide a user interface that is easy to understand and use by all stakeholders.
Integrasi Sistem Manajemen SDM	This feature enables seamless integration with human resource management systems.
Payroll History	Maintain employee payroll history for tracking and auditing.
Bonus and Incentive Management System	Maintain employee payroll history for tracking and auditing.
Data Security	Ensure the security of employee data and salary information through access control and encryption.
Reports and Analytics	Provide periodic payroll reports and performance analyses to support decision-making.
Notifications and Reminders	Send notifications and reminders regarding payroll deadlines, taxes, and other policies.

The intuitive user interface supports easy access and understanding for all stakeholders. The payroll history function and bonus and incentive management system provide transparency and support for fair remuneration policies. Tight data security protects sensitive information. Comprehensive reports and analyses provide deep insights to support strategic decision-making. Notifications and reminders help maintain administrative order and schedule compliance. Altogether, these features create a responsive, efficient payroll system suited to construction companies' business needs.

User Acceptance Analysis

The user acceptance analysis of the employee payroll system in a construction company showed positive performance and good acceptance. Functionality testing confirmed that the system could perform core functions accurately, especially in salary calculation and employee data management. User testing showed that the user interface was rated as intuitive and easy to use, with most users satisfied with the system usage experience. Performance evaluations reflected fast responsiveness and adequate capacity to handle peak workloads. Validation with stakeholders showed that the system met the company's policies and needs, which was welcomed by management and HR. User acceptance analysis concluded that the payroll system was well received, although there were some minor areas of improvement to enhance the user experience. Overall, the results of the analysis show that the implementation of the employee payroll system has been successful and effective in meeting stakeholders' expectations.

Table 3. Application Testing

Application Features	Results	Note
Salary Calculation	Successful with 98% Accuracy	Error-free salary calculation process
Employee Data Management	Running Smoothly and as Expected	Adding, deleting, and updating data works well.

Application Features	Results	Note
User Interface	Intuitive and Easy to Use	Users rated the interface as user-friendly.
Response Speed	Average Response Time Less than 2 Seconds	The system responds quickly
System Capacity	Capable of Handling Peak Load	No performance degradation when user load increases
Tax Withholding Validation	Validation Successful, as Required	Tax regulations make tax deductions.
Notification System	Notifications and Reminders Work Well	Users get notifications in a timely manner

The test results, Table 3, of the payroll system response speed show an average response time of less than 2 seconds. This analysis reflects the level of efficiency and performance of the system in responding to user requests. The fast response speed is a positive indicator, providing a smooth user experience and minimizing waiting time. Users can quickly access salary information and perform system functions without significant bottlenecks. Good response speed can also support user productivity and maintain their satisfaction with the payroll system experience. With these results, the system's response speed feature performs well and meets users' expectations in terms of responsiveness.

It should be noted that continuous system performance monitoring is necessary to ensure that the response speed remains optimal over time and user growth. Testing involved users to get feedback on the user interface and ease of use. As a result, users rated the user interface as intuitive and easy to use, and 88% of users were satisfied with the system usage experience.

CONCLUSION

This research successfully developed an employee payroll system for a construction company using the Extreme Programming (XP) method, and the research conclusions highlighted the successful implementation and positive user and stakeholder acceptance. The built system features an intuitive user interface, optimized response speed, and accurate functionality in salary calculation and employee data management. User acceptance analysis illustrated that the system received a positive response, and validation with stakeholders showed that the system met the company's policies and needs. Despite the successful implementation, further development recommendations focused on monitoring response speed, tax regulation updates, and user feedback to maintain and improve the system's quality over time. Thus, this research confirms that Extreme Programming (XP) methods can provide adaptive and practical solutions in developing employee payroll systems, positively impacting salary management efficiency and user acceptance.

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