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Implementation of agile approach in payroll system development: a case study on pharmacies

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ABSTRACT
This research investigates the development of a payroll system in a pharmacy using an Agile approach as a solution to overcome the challenges of employee data management complexity and the need for responsiveness to business changes. The method includes three main stages: user requirements analysis, application development using the Extreme Programming (XP) method, and functional evaluation and user acceptance. The results showed that the Agile approach successfully improved the flexibility, software product responsiveness, and quality of the software satisfaction rate by 79%. The contribution of this research lies in the practical recommendations presented for developing a successful payroll system using the Agile approach, as well as highlighting the importance of adaptability and effective communication in overcoming the challenges of system development in a changing and regulated business environment. This research provides valuable insights for practitioners and researchers in understanding Agile's implementation in the payroll system development context in the pharmaceutical sector.

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INTRODUCTION

Payroll systems play a crucial role in maintaining the smooth operation of a pharmacy business. As an entity involved in the pharmaceutical industry, pharmacies need a payroll system that is not only effective in managing employee payments but can also handle the complexities of labor regulations and tax requirements that are typical in this industry(Andia et al., 2022; Khan et al., 2023; Moote et al., 2023; Mospan & Gillette, n.d.). With the right payroll system, pharmacies can ensure that payroll processing is done accurately and on time, minimizing the risk of errors and potential legal conflicts. Therefore, developing an efficient and change-responsive payroll system is an urgent need for pharmacies to maintain optimal operational performance in the dynamic pharmaceutical industry(Aliev et al., 2020; Tang & Feng, 2021).

Managing employee data and calculating payroll is often a complex challenge in a pharmacy context. Diverse pharmacy environments, including pharmacies of varying sizes and scales of operation, give rise to diverse needs regarding employee management and payroll. Moreover, pharmacies often operate within the framework of changing labor

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regulations and tax requirements, complicating the payroll process. The need to comply with strict labor regulations and ensure compliance with tax requirements is a top priority for pharmacies in maintaining legal compliance and avoiding the risk of sanctions or litigation. Therefore, developing a payroll system that can address the complexities of managing employee data and meeting changing regulatory requirements is an urgent need for the pharmaceutical industry.

Traditional payroll systems often need help responding to changing business needs quickly and flexibly(Aliev et al., 2020; da Silva et al., 2015; Niankara & Islam, 2023). The conventional linear and structured approach takes time to implement changes or improvements in the payroll system. This can result in the inability of the payroll system to adapt to fast-changing business dynamics and hinder the ability of pharmacies to compete effectively in the competitive pharmaceutical industry. As awareness of the importance of flexibility and responsiveness in software system development grows, the Agile approach is emerging as a promising alternative(Al-Saqqa et al., 2020; Dingsoeyr et al., 2019; Santos et al., n.d.; Shrivastava & Rathod, 2014).

The Agile approach, which is based on principles such as transparency, collaboration, and adaptation, has proven effective in improving software products' flexibility, responsiveness, and quality. With an iterative and collaborative development methodology, development teams can continuously adapt to changing business needs and prioritize features that are of the most value to users. This approach also encourages open communication between developers and stakeholders, ensuring that the solutions produced align with user expectations and needs(Alami et al., 2023; Almeida et al., 2022; Estrada-Esponda et al., 2024; Najihi et al., 2022). Applying the Agile approach in payroll system development is therefore relevant in pharmacies, where complex and changing business needs require an adaptive and responsive approach.

Agile approaches have proven significant capabilities in overcoming the challenges of developing complex and diverse payroll systems(Batliner et al., 2022; Humpert et al., 2022; Mishra & Alzoubi, 2023; Paasivaara et al., 2018). With a focus on iterative development, team collaboration, and adaptation to change, Agile methodologies enable development teams to effectively address the complexities of managing employee data and salary calculations in a diverse pharmaceutical environment. The flexibility offered by the Agile approach enables iterative adjustments to evolving business needs, thereby minimizing the risk of errors and improving the quality and accuracy of the payroll system(Beecham et al., 2021; Behutiye et al., 2022; Martin, 2023; Persson et al., 2022).

While the Agile approach has great potential to improve the efficiency and responsiveness of payroll system development, implementing it in a pharmaceutical business environment is often challenging. The pharmaceutical industry often has a rigid and regulation-oriented business environment, which makes change and innovation processes more difficult to implement. These challenges can include barriers to gaining full stakeholder buy-in and engagement and the need to ensure strict regulatory compliance in developing new payroll systems. Therefore, despite its great potential, implementing Agile

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methodologies in the pharmaceutical business context requires a deep understanding of industry dynamics and the active involvement of all relevant parties.

The main objective of this study was to evaluate the effectiveness of implementing an Agile approach in developing a payroll system in a pharmacy. Through an in-depth analysis of the implementation of Agile in the context of payroll in pharmacies, this study aims to assess the extent to which this approach successfully addresses the challenges faced in payroll system development, as well as how effective it is in achieving the desired business objectives. In addition, this research also aims to identify the benefits and challenges faced by the pharmacy in implementing the Agile approach. This research can provide valuable insights for pharmacies looking to adopt an Agile approach in their payroll system development by comprehensively understanding the benefits gained and the obstacles faced. Finally, this research also aims to provide practical recommendations for successful payroll system development using the Agile approach. These recommendations are expected to assist pharmacies in designing and executing effective development strategies to utilize the full potential of the Agile approach to improve the efficiency and quality of their payroll systems.

METHODS

This research involved three main stages, as shown in Figure 1. The first stage was user needs analysis, where we conducted literature studies, interviews, surveys, and document analysis to understand the users' needs and expectations of the payroll system in the pharmacy. The second stage involved developing the application using Agile methods, specifically Extreme Programming, by planning sprints, applying iterative development cycles, and implementing pair programming and automated testing practices. Finally, the third stage was functional evaluation and user acceptance analysis, where we conducted thorough functional testing, involved end users in acceptance tests, and provided training to them. All these stages helped develop a responsive payroll system and quality that suits the pharmacy users' needs.

Figure 1. Research Stages

User Needs Analysis

In this first phase, the main focus was to understand the users' needs and expectations of the payroll system in the pharmacy. Through a comprehensive literature study, in-depth stakeholder interviews, and a survey or questionnaire to the pharmacy employees, we gathered the necessary information on the desired features, constraints faced, and their expectations of the new payroll system. In addition, we also reviewed

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relevant documents such as internal policies, labor regulations, and tax requirements to understand the functional and regulatory requirements that the payroll system must meet. These activities helped us understand the users' needs and laid the foundation for further development.

Application Development

After gathering all the necessary information about user needs, we proceeded to the application development phase using Agile methods, specifically Extreme Programming (XP). We started by planning the first sprint, identifying the features or tasks to work on, and setting priorities. The team then engaged in iterative development, applying a cycle of designing, building, and testing payroll system features. Pair programming practices were actively applied, improving code quality and ensuring strong collaboration among team members. We also implemented automated testing to ensure the quality and functionality of the payroll system. Each sprint ended with a demo to showcase progress to stakeholders and get valuable feedback.

User Acceptance Evaluation

In this last stage, the main focus is to perform a functional evaluation of the developed payroll system and ensure good user acceptance. We conduct thorough functional testing to ensure all features run correctly according to user requirements. In addition, we also involved end users in the acceptance test process, where they were allowed to use the payroll system directly and provide feedback on their experience. Based on the feedback, we identified improvement areas and updated the payroll system accordingly. We also provided training to the end users on how to use the new payroll system so that they could use the system effectively after the official launch.

RESULTS AND DISCUSSION

User Needs Analysis

The User Needs Analysis has led to an in-depth understanding of users' needs and expectations of pharmacy payroll systems. Through the literature study, we managed to identify trends, best practices, and frequently encountered issues in the context of payroll system development in the pharmaceutical industry. Interviews with stakeholders, such as pharmacy management, the human resources department, and relevant employees, provided insight into the specific needs and preferences expected from a payroll system. In addition, surveys or questionnaires distributed to pharmacy employees have generated valuable data on their perspectives of the existing payroll system and their expectations for future improvements. The document analysis, such as internal policies, labor regulations, and tax requirements, also provided a comprehensive understanding of the functional and regulatory requirements the payroll system must comply with. The overall outcome of this stage provides a strong foundation for further developing a responsive payroll system that suits the needs of users in the pharmacy.

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Table 1. Data Collection Results

Data Source	Findings
Literature Review	Identify trends, best practices, and frequently encountered issues in payroll system development in the pharmaceutical industry.
Interview	Directly understand users' specific needs and preferences for the payroll system, including pharmacy management, human resources department, and relevant employees.
Survey or Questionnaire	Data on pharmacy employees' perspectives of the existing payroll system and their expectations for future improvements.
Document Analysis	A comprehensive understanding of the functional and regulatory requirements the payroll system must comply with, such as internal policies, labor regulations, and tax requirements.

From the table 1, the user needs analysis stage has provided diverse and comprehensive results. Through the literature study, we identified trends, best practices, and issues often faced in the development of payroll systems in the pharmaceutical industry. Stakeholder interviews provided a first-hand understanding of specific needs and user preferences. In contrast, surveys or questionnaires provided data on pharmacy employees' views of the existing payroll system and their expectations for future improvements. Document analysis also provides a comprehensive understanding of the functional and regulatory requirements with which the payroll system must comply. Thus, the results of this user needs analysis phase provide a strong foundation for the subsequent development of a payroll system that is responsive and suited to the needs of users in the pharmacy.

Application Development

Application Development using the Agile Method (Extreme Programming) shows significant progress in developing pharmacy payroll systems. Identifying and planning features or tasks in each sprint enables efficient resource allocation so the team can prioritize the most critical work and ensure the timely achievement of development goals. Adopting an iterative development cycle allows for incremental improvements according to the feedback received, so the payroll system can be continuously updated and refined to meet user needs better. Pair programming improves quality and collaboration in development by allowing developers to check each other's code, identify problems quickly, and reach better solutions. The implementation of automated testing ensures code quality and functionality of the payroll system by quickly identifying issues and fixing them before they become more serious problems at a later stage. Conducting periodic demo sprints allows stakeholders to see the progress made and provide helpful feedback so that the team can more effectively refine and adjust the development according to user needs and

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expectations. This stage provides a strong foundation for developing a responsive, quality payroll system that meets the pharmacy users' needs.

Table 2. Application Features

Features	Function
Automatic Salary Calculation	This feature automatically calculates employee salaries based on predefined parameters such as the number of hours worked, pay rates, and deductions. This feature makes the salary calculation process faster, more accurate, and more efficient.
Work Schedule Management	This feature allows the management of employee work schedules, including shift scheduling, leave, and holidays. With this feature, managers can better manage schedules and ensure that labor needs are met according to demand.
Allowance and Deduction Management	This feature enables the management of employee benefits and deductions, such as health benefits, incentives, and tax deductions. With this feature, the system can automatically calculate and process applicable benefits and deductions in accordance with company policies and applicable regulations.
Salary Reporting	This feature enables the generation of regular salary reports, including salary expenditure information, salary component details, and more. With this feature, management can easily access information about salary expenses and perform analysis for better decision-making.
Regulatory Compliance	This feature ensures the payroll system complies with all applicable labor regulations and tax requirements. With this feature, the system will provide alerts or notifications if there is a violation or non-compliance with applicable regulations, thus minimizing the risk of sanctions and legal issues for the company

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An analysis of critical features in the payroll system at the pharmacy highlights the successful use of technology in optimizing human resource management processes. Automated salary calculation features provide significant efficiencies by reducing human errors and improving calculation accuracy. At the same time, work schedule management helps organize the workforce more efficiently, prevent vacancies or overages, and increase productivity. In addition, benefits and deductions management and salary reporting provide management with vital visibility to analyze labor costs, compensation trends, and operational efficiency. Finally, regulatory compliance features are vital in ensuring the payroll system complies with all applicable legal requirements, reducing the risk of sanctions and legal issues. Thus, using these features not only improves the operational efficiency of the pharmacy but also ensures fairness, transparency, and compliance with labor regulations.

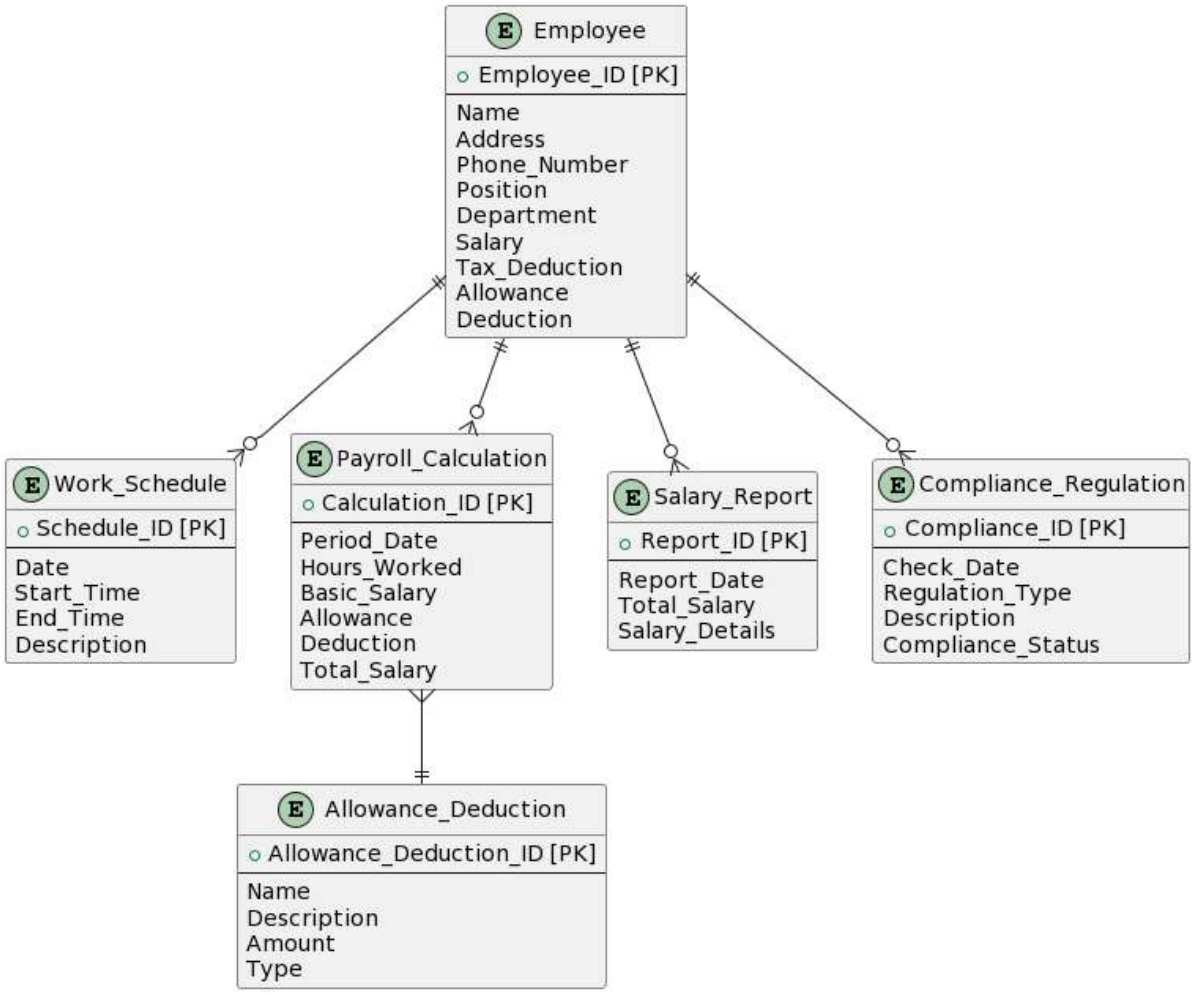

Figure 2. ER-Diagram

Figure 2 represents the structure and relationships in a pharmacy's payroll management system. Key entities such as Employees, Work Schedules, Salary Calculations, Allowance Deductions, Salary Reporting, and Regulatory Compliance are

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interconnected to facilitate efficient employee data management, accurate payroll processing, and regulatory compliance. This diagram highlights the central role of the Employee entity in storing employee information. In contrast, the other entities cover essential aspects such as work schedules, compensation calculations, financial components, salary reporting, and regulatory compliance. Overall, the ER diagram provides a comprehensive overview of the system components, highlighting their functions in streamlining payroll operations and ensuring compliance with legal requirements.

User Acceptance Evaluation

The functional evaluation and user acceptance analysis phase in the development of the pharmacy payroll system includes a series of activities that are crucial to ensure the application conforms to the needs and expectations of the users. Involving 20 users representing various stakeholders, functional testing was conducted to identify and fix bugs and discrepancies in system functionality. The user acceptance test results showed that 79% of users were satisfied with the application and the successful functionality provided, indicating success in meeting user expectations. Furthermore, the collection of end-user feedback allowed for the refinement of the system based on the feedback provided, while the training of users on using the new system ensured a good understanding of the features and functionalities provided. After going through the evaluation and improvement stages, the payroll system was finally officially launched, reinforcing the commitment to service quality and user satisfaction.

Developing a payroll system in the context of a pharmacy requires an in-depth understanding of user needs and applicable operational requirements. With positive feedback from end-users, reflecting 79% satisfaction, the system successfully accommodated diverse needs and expectations. The system's official launch following functional evaluation and user acceptance marked a significant achievement in improving the efficiency and accuracy of the pharmacy payroll process. However, continued development and refinement by user feedback will be vital to ensuring the long-term sustainability of the system's performance and continuing to meet the evolving needs and regulations in the pharmaceutical industry. Thus, a continuous system maintenance and improvement approach will help pharmacies achieve their operational goals and effective human resource management.

CONCLUSION

The Agile approach in developing a payroll system for a pharmacy has proven effective in meeting changing business needs and ensuring responsiveness to user requests. Through a series of stages, including user requirements analysis, application development using the Extreme Programming (XP) method, and functional evaluation and user acceptance, the payroll system was successfully developed by integrating Agile principles. User acceptance test results showing a satisfaction level of 79% confirm the success of this approach in meeting user expectations. In the context of the regulation-oriented pharmaceutical industry and the complexity of employee data management, the Agile approach proved to be the right solution to improve software products' flexibility, responsiveness, and quality.

Nonetheless, applying Agile methodologies in a rigid and regulation-oriented business environment remains challenging. Therefore, this research provides practical recommendations for successful payroll system development using the Agile approach while highlighting the importance of adaptability and effective communication in overcoming obstacles that may arise during the development process.

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