Implementing Agile Scrum in Dental Clinic Finance Software Development

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Article Info	ABSTRACT
Keywords: Finance Software, Agile Methodology, Dental Clinics.	This research addresses a crucial problem in the financial management of dental clinics in the digital era, requiring effective solutions to enhance efficiency and quality of dental healthcare services. The Agile Scrum methodology is implemented in the development of financial software for dental clinics as a responsive and adaptive solution to the complexity of financial processes, limited financial resources, and the need for real-time monitoring. Through a combination of qualitative interviews with stakeholders and quantitative data analysis, this study evaluates the effectiveness of Agile Scrum in addressing financial management challenges faced by dental clinics. The research findings indicate that the implementation of Agile Scrum in financial software development has made a significant contribution by improving operational efficiency, accuracy of financial management, and user satisfaction, thereby making an important contribution to enhancing the quality of dental healthcare services.
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INTRODUCTION

In today's digital era, the financial management of dental clinics has become increasingly crucial, with software as a critical element in enhancing the efficiency and quality of dental healthcare services(Bhat et al., 2023; Das et al., 2021; Mahdi et al., 2023). Modern dental clinics rely not only on software for patient management and medical records but also on financial aspects. One of the significant challenges in dental clinic financial management is its complex processes. This management involves various aspects, such as patient payment processing, insurance billing, inventory management, and operational cost management. This complexity can make tracking and managing all financial transactions difficult. Additionally, dental clinics require a real-time system that can monitor financial performance, including revenue analysis, expenses, and service profitability(Al-Hassan & AlQahtani, 2019; Chau et al., 2024; Cheng et al., 2023; Montoya et al., 2023; Ramli et al., 2023; Sachedina et al., 2023; Shu et al., 2024; Song et al., 2024).

Dental clinics also often need more financial resources, including budgets for software development. This limitation can restrict their access to sophisticated and comprehensive financial management solutions, leading them to rely on less efficient manual solutions. Therefore, they need solutions that can automate processes, enhance accuracy, and

reduce the risk of human errors. It is crucial for dental clinics to adopt the right technological solutions, including the development of responsive, adaptive, and tailored financial software. The implementation of Agile Scrum in the development of financial software for dental clinics is not just relevant, but it also holds the potential to significantly enhance efficiency, accuracy, and compliance with financial regulations(Alami et al., 2022, 2023; Almeida et al., 2022; Estrada-Esponda et al., 2024; Hasan et al., 2013; Meiliana et al., 2023; Michalides et al., 2023).

Traditional methodologies in software development, such as the Waterfall Model, have limitations(Lee et al., 2022; Leong et al., 2023; Najihi et al., 2022; Suharto et al., 2018). This needs to be more responsive to user needs and involve low user and developer engagement. Hence, the Agile approach in software development becomes a more adaptive and collaborative solution(Al-Saqqa et al., 2020; Bomström et al., 2023; Dingsoeyr et al., 2019; Mishra & Alzoubi, 2023; Rindell et al., 2021; Santos et al., n.d.; Shrivastava & Rathod, 2014). One popular Agile approach is Scrum, emphasizing iterative and incremental product development through regularly scheduled sprints. This approach is relevant in dental clinics, particularly in developing financial software.

However, the implementation of Agile Scrum may also face specific challenges, such as managing frequent user requirement changes, team adaptation to new methodologies, and accurate performance measurement. This underscores the relevance and criticality of research on the application of Agile Scrum in developing software for dental clinics. This study aims to explore the implementation of Agile Scrum in developing financial software for dental clinics, identifying benefits, challenges, and lessons learned from applying this methodology. The goal is to develop practical guidelines that can be readily applied to improve efficiency and quality in developing dental healthcare software through a more adaptive and responsive Agile approach.

METHODS

This research involves four main stages as depicted in Figure 1: Requirement Definition, Planning, Development, and Functional Testing and User Acceptance Analysis. The Requirement Definition stage focuses on conducting comprehensive user needs analysis, including stakeholder interviews and documentation of user stories and functional requirements. A detailed project plan is created in the Planning stage, including resource allocation, schedule, budget estimation, and backlog prioritization. Development involves iterative programming based on specifications, with regular code reviews and daily meetings to ensure progress and quality. Finally, the Functional Testing and User Acceptance Analysis stage entails thorough testing to ensure functionality, usability, and alignment with user requirements before implementation. These stages are crucial for applying the Agile Scrum methodology in developing customized financial software for dental clinics, aiming to improve efficiency, accuracy, and user satisfaction in managing clinic finances.
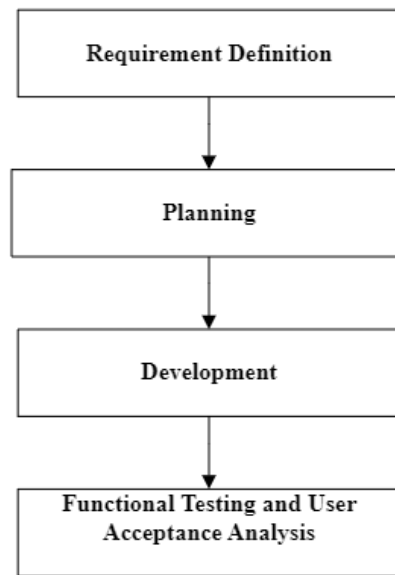
Figure 1. Research Stages

Requirement Definition

The first and crucial stage in software development is Requirement Definition. This stage lays the groundwork for the entire process, involving a comprehensive analysis of user needs. It includes interviews with stakeholders such as dentists, clinic administrators, and finance staff to grasp their requirements and expectations for the software. Documentation in user stories, use cases, and functional requirements is detailed to specify the functional and non-functional requirements needed in software development.

Planning

In the Planning stage, the main activity is to create a comprehensive project plan. This includes identifying necessary resources such as personnel, time, and budget and developing a project plan that covers activity scheduling, resource allocation, cost estimation, and milestone determination. Furthermore, a product backlog is compiled as a list of features and functions to be developed along with their priorities, ensuring a clear focus on goals throughout the software development process.

Development

The Development stage, a dynamic and iterative process, is where software development takes place. In the Agile Scrum methodology, this activity is conducted iteratively in the form of sprints. Development teams engage in coding and programming based on previously established specifications and requirements. Code review processes and daily stand-up meetings are also conducted to ensure quality, consistency, and progress aligned with the pre-defined plan.

Functional Testing and User Acceptance Analysis

Finally, the Functional Testing and User Acceptance Analysis stage is the final testing and evaluation phase before the software is deemed ready for use. Test cases that have

been developed are tested to ensure that the software functions as expected without significant bugs or errors. Users play a pivotal role in the user acceptance testing phase, evaluating usability, performance, and software compliance with their needs. The results of testing and user feedback are used to analyze whether the software meets user expectations and requirements or requires additional adjustments and improvements before widespread implementation.

RESULTS AND DISCUSSION

Requirements Definition

The results of the Requirement Definition stage have yielded several significant outcomes: A comprehensive user requirements analysis is the cornerstone of our progress in the Requirement Definition stage. This crucial step has allowed us to delve deep into the needs and expectations of our users, forming the bedrock of our software development process. It has involved identifying both functional and non-functional requirements that are pivotal for our users. Successful interviews with stakeholders such as dentists, clinic administrators, and finance staff have been conducted. These interviews have effectively identified the requirements, considering each stakeholder's diverse perspectives and interests. We have compiled detailed documentation as a testament to our commitment to transparency and clarity. This documentation, comprising user stories, use cases, and functional requirements, is a comprehensive roadmap for our software development process. It ensures the development team has a shared vision and a clear understanding of the software's requirements. These documents provide a clear overview of the software's functional and non-functional requirements. Lastly, team meetings have been held to validate and clarify requirements with the development team members. This ensures a precise understanding of user needs, and the development team has a shared vision in developing the software according to the established requirements as shown in Table 1.

Tabel 1. Results of defining requirements

Data Source	Results
Comprehensive user requirements analysis	Achieved a deep understanding of user needs and expectations regarding the software being developed. This includes identifying both functional and non-functional requirements essential for users.
Successful interviews with stakeholders	Conducted successful interviews with stakeholders such as dentists, clinic administrators, and finance staff. These interviews effectively identified the necessary requirements, considering the diverse perspectives and interests of each stakeholder.
Detailed documentation including user stories, use cases, and functional requirements	Compiled detailed documentation comprising user stories, use cases, and functional requirements, providing a clear overview of the functional and non-functional requirements to be met by the software being developed.
Validation and clarification of	Held team meetings to validate and clarify requirements

Data Source	Results
requirements through team meetings	with development team members, ensuring a precise understanding of user needs and a shared vision for software development in line with established requirements.

Planning

The Planning stage in developing software for dental clinics has yielded several crucial outcomes as shown in Figure 2. Firstly, successfully identifying resources required for development, including personnel with appropriate skills, allocation of time, and realistic budget estimation, has been achieved. This aims to ensure the smooth progress of the project by having the right resources in place and effectively managed. Secondly, a comprehensive project plan has been created, encompassing precise scheduling of activities, effective resource allocation, accurate cost estimation, and establishing project milestones to provide a clear direction in achieving project objectives. A detailed product backlog has been compiled, listing features and functionalities to be developed along with their priorities. This is to ensure a focused approach to developing the most critical features and effectively meeting user needs. Lastly, sprint planning meetings with the development team have been conducted to plan the first sprint meticulously, select backlog items to work on, and set specific sprint goals. This structured approach helps organize and direct development efforts efficiently and measurably toward project success.
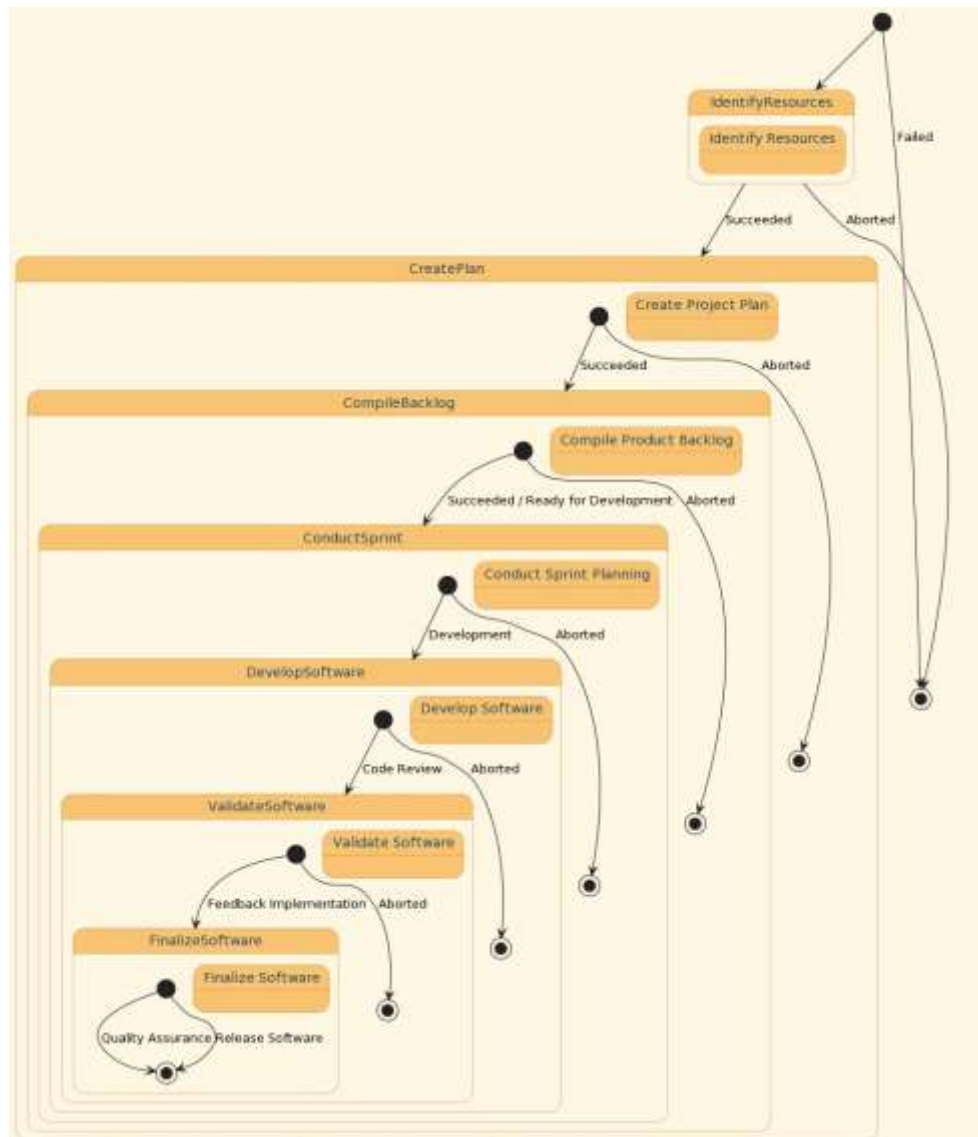
Figure 2 The Planning Phase

Development

The results of the Development stage as shown in Figure 3 in software development are as follows. Firstly, the development team applies the Agile Scrum methodology by conducting sprint development iterations. A sprint is a defined period during which the team works to complete a set of tasks identified in the product backlog. Secondly, the team performs coding and programming based on the specifications and requirements estab-lished during the planning stage. They ensure that the developed code adheres to quality standards and meets the functional and non-functional requirements.

Furthermore, regular code reviews are conducted to ensure quality and consistency in the developed code as shown in Figure 3. This involves reviewing each other's code to identify and fix bugs and ensuring that the code is well-documented and easily understood by other team members. Lastly, daily stand-up meetings are held where the development

team provides updates on progress, addresses any obstacles encountered, and updates plans as necessary. This helps maintain effective communication among team members and ensures that the project progresses according to plan.
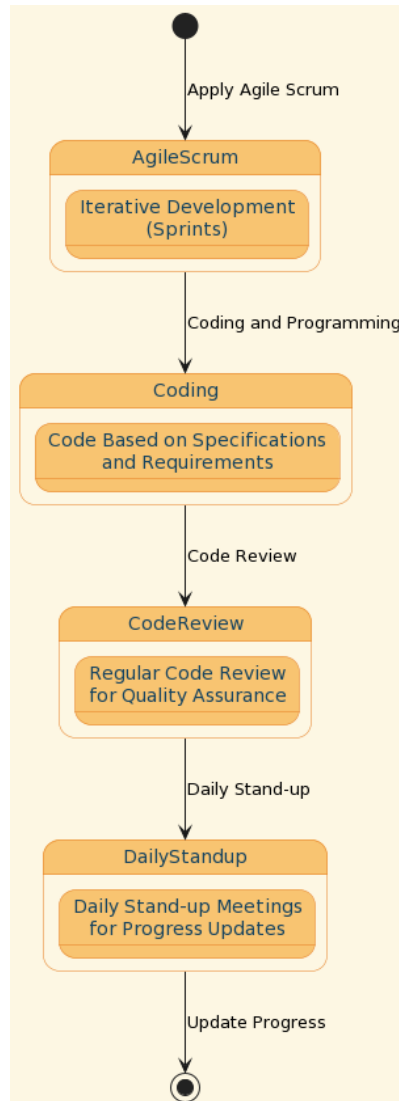
Figure 3 Development Phase

Figure 3 illustrates the Development stage in software development, focusing on implementing the Agile Scrum methodology. The diagram depicts an iterative development process through sprints, coding based on specifications and requirements, regular code reviews for quality assurance, and daily meetings for progress updates. This diagram emphasizes the structured and collaborative approach taken during the development phase, highlighting the importance of continuous improvement, code quality, and effective communication within the development team.

Functional Testing and User Acceptance

The Functional Testing and User Acceptance Analysis stage results demonstrate significant achievements in software development. The development team successfully developed test cases that align with the predefined functional and non-functional requirements. During the functional testing phase, the team verified that the software operated as expected, and no significant bugs or errors that could disrupt system performance were found. Additionally, through User Acceptance Testing (UAT), users were directly involved in the testing process to evaluate the software's usability, performance, and alignment with their needs. The results of the testing and feedback from users provide valuable insights for the development team to evaluate the quality and effectiveness of the software. Thus, this stage assures that the software has undergone thorough testing and is ready for widespread implementation, with the expectation of providing optimal benefits to end users.

CONCLUSION

Implementing Agile Scrum in dental clinic finance software development significantly enhances efficiency, accuracy, and compliance with financial regulations. The Agile Scrum methodology enables rapid iterations through sprints, allowing for more responsive adjustments to user and stakeholder needs. The Requirement Definition stage aids in better understanding user requirements, while the Planning stage facilitates efficient resource allocation. The Development stage utilizes sprints and code reviews to ensure high-quality code, while the Functional Testing and User Acceptance Analysis stage ensures software quality and usability before widespread implementation. Thus, this research provides practical guidelines for optimizing dental clinic finance software development through an adaptive and responsive Agile approach.

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