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Implementing Agile Approach In Inventory Management Development To Enhance Performance Of Fitness Centers

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ABSTRACT
This study aims to develop a responsive and efficient membership management application for fitness centers using the Extreme Programming (XP) Methodology. Challenges encountered in membership management at fitness centers include complex registration processes, difficulties tracking payments, and inefficient member data management. The methodology involves system requirements analysis involving stakeholders, application design and implementation using XP approaches such as short iterations and continuous testing, and trial and evaluation involving internal teams and fitness center members. The result is an application that integrates essential features such as membership management, class scheduling, payments, member progress reporting, communication, and equipment reservations. Alpha and beta testing, as well as member performance and response evaluations, indicate that this application can meet user expectations and enhance the operational efficiency of fitness centers. This research contributes to providing technological solutions that improve fitness center membership management processes with a responsive and practical approach in line with XP principles in software development.

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INTRODUCTION

In this modern era, the fitness and health industry is experiencing rapid growth, with an increasing number of people becoming aware of the importance of healthy living(Blocken et al., 2020; Brandt et al., 2023; Cabitza et al., 2015; Javaid et al., 2022). This is reflected in the growing number of fitness centers in both large and small cities. Alongside this growth, inventory management becomes increasingly important to ensure smooth, efficient operations and provide quality customer service. One of the main challenges fitness centers face is expanding services and diversifying products to meet customers' increasingly complex needs. This includes introducing new training programs, providing more advanced equipment, and developing additional services such as nutritional consultations or personal training. By applying Agile approaches in inventory management, fitness centers can be more responsive to these changes and ensure the availability of resources needed to provide comprehensive services.

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Fitness center inventory management challenges include stock management, equipment updates, supply management, and room usage management. The inability to address these challenges can result in decreased operational performance, increased costs, and decreased customer satisfaction. One emerging approach to improving inventory management performance is the Agile approach. Originally widely used in software development, this approach has been proven effective in enhancing flexibility, responsiveness, and work quality(Al-Saqqa et al., 2020; Dingsoeyr et al., 2019; Dingsøyr et al., 2012; Santos et al., n.d.; Serrador & Pinto, 2015; Shrivastava & Rathod, 2014). Applied in the context of inventory management development in fitness centers, the Agile approach promises significant customer performance and experience improvements.

Previous research has shown that implementing Agile in non-IT contexts, such as inventory management, can significantly improve response time, risk management, and adaptability to market changes(Abusaeed et al., 2023; Altuwaijri & Ferrario, 2022; Beecham et al., 2021; Behutiye et al., 2022; Dingsøyr & Lassenius, 2016; Hinderks et al., 2022; Leong et al., 2023; Pérez-Piqueras et al., 2023; Persson et al., 2022; Senabre Hidalgo, n.d.; Udvaros et al., 2023; Wiechmann et al., 2022). However, specific research related to the application of Agile in the context of fitness centers still needs to be completed, making this study a valuable contribution to expanding our understanding of Agile potential beyond software development. Additionally, through this research, practical recommendations are expected to be found that can be applied by fitness center owners and managers to improve their operational performance. Thus, this research will not only make an academic contribution but also directly impact improving the fitness industry's effectiveness and competitiveness as a whole.

One of the main advantages of the Agile approach is its ability to prioritize team collaboration and rapid iterations(Alami et al., 2022, 2023; Almeida et al., 2022; Estrada-Esponda et al., 2024). In fitness center inventory management development, effective collaboration among management teams, field staff, and suppliers is critical to maintaining operational smoothness. Applying Agile principles creates a responsive and adaptive work environment to respond to changing customer needs and demands. Furthermore, the development of information technology has also significantly contributed to the fitness industry's transformation. Mobile applications, cloud-based inventory management systems, and sensor technology in fitness equipment are increasingly dominating the market. Thus, Agile-adapted inventory management development can also leverage this technology to improve efficiency and accuracy in inventory management. In addition to internal factors, regulatory and compliance aspects are essential considerations in fitness center inventory management. The involvement of various parties, such as health authorities, equipment suppliers, and service providers, must also be considered in developing adaptive and effective inventory systems. The Agile approach can help address this complexity by prioritizing transparency, effective communication, and collaborative problem-solving.

Stock and inventory management are crucial aspects of fitness center operations. Delays in stock updates or equipment shortages can directly impact customer experience and business reputation. Using the Agile approach, the stock management process can be optimized through adaptive planning, real-time monitoring, and quick decision-making based on

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accurate data. Furthermore, supply management aspects are also a significant focus of this research. Dependence on reliable suppliers, efficiency in procurement processes, and supplier performance evaluations must be considered in developing effective inventory management. The Agile approach can help improve these processes through continuous monitoring, learning, and data-driven improvements. In addition to stock and supply management, room usage management is crucial to fitness center operations. Optimizing room usage, efficient scheduling, and flexibility in space adjustments are challenges that must be addressed. By applying Agile principles, solutions can be found that allow fitness centers to manage their space more effectively and be responsive to changing needs. Equally important is software development or information systems that support inventory management. In this context, using Agile methodology in software development can provide advantages in terms of flexibility, adaptability, and delivering quality products quickly. Integrating software development and inventory management holistically can strengthen the foundation of fitness center operations.

In addition to direct benefits in operational efficiency and service quality, implementing Agile approaches in fitness center inventory management can have broader impacts on the fitness industry. Innovations in inventory management can serve as examples for other fitness centers, triggering the adoption of technologies and best practices that can enhance competitiveness and customer experience across the industry. Thus, this research aims to identify the potential application of Agile approaches in the development of inventory management in fitness centers. Through this approach, innovative solutions can be found to improve efficiency, responsiveness, and customer satisfaction.

METHODS

Developing inventory management applications for fitness centers using Agile approaches involves three main stages. The first stage is system requirements analysis, which involves identifying stakeholder requirements, analyzing business processes, and preparing system requirement documentation. The second stage is application design and implementation, which includes technology selection, system design creation, application feature development, system integration, and documentation creation. The final stage is testing and evaluation, including functional, performance, security, beta, user evaluation, application improvement, user training, and application launch. With this systematic approach, application development can be carried out efficiently and effectively using scientific writing principles.

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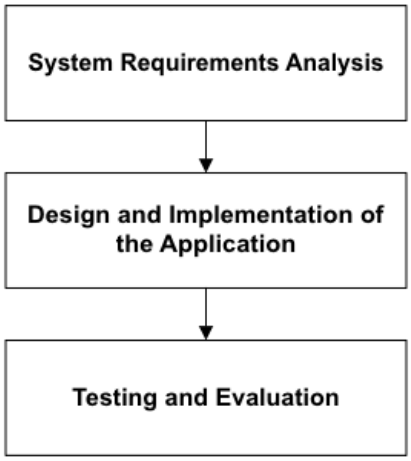

Figure 1. Research Stages

System Requirements Analysis

The first stage in developing an inventory management application for a fitness center using the Agile approach is system requirements analysis. In this stage, requirements from various stakeholders, such as fitness center owners, managers, and related staff, are identified. Interviews are conducted to understand the business processes involved in inventory management, including stock management, equipment updates, supply management, and room usage. The results of this analysis are then used to determine the functional and non-functional requirements of the application and to compile a system requirement specification document that will guide the next stage.

Design and Implementation of the Application

Once the system requirements analysis stage is completed, the next step is the design and implementation of the application. In this stage, technologies for application development are selected, such as programming languages, databases, and frameworks. The development team then creates a system design that includes application architecture, database design, user interface, and business logic. Application features are developed based on the system requirement specification document; unit testing is performed to ensure functionality and various application components are integrated to form a cohesive system.

Testing and Evaluation

After the application is built, the next stage is testing and evaluation. In this stage, functional testing ensures that all application features function correctly as expected. In addition, performance testing is conducted to measure application performance, security testing is performed to identify security vulnerabilities, and beta testing with beta users is carried out to obtain feedback. The testing and evaluation results are then used to improve and update the application before user training and the official application launch.

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RESULTS AND DISCUSSION

User Needs Analysis

After identifying the core requirements of the membership management application for fitness centers, a deep understanding of the functionality that should be included in the application was obtained, such as member data management, payment systems, class scheduling, and member progress reporting. Surveys and interviews conducted with fitness center owners, trainers, and members yielded rich information about their needs and expectations for the application. The resulting requirement analysis document includes detailed functional and non-functional requirements and mapping these requirements to the features to be implemented in the application. The data collected from surveys and interviews serve as a strong foundation for directing the application development process toward meeting user expectations and needs.

Table 1 provides a more comprehensive overview of the core requirements of each stakeholder in developing the membership management application for fitness centers. This includes critical requirements, challenges faced, and their expectations and desires for the application to be developed.

Table 1. Data Collection Results

Stakeholder	Key Needs	Addressed Challenges	Expectations and Desires
Gym Owner	1. Membership data management	- Streamlined registration process	- System capable of managing member data accurately and efficiently
	2. Payment system	- Reduced payment errors and tracking issues	- Easy payment processing and financial reporting
	3. Member progress reporting	- Structured assessment and evaluation of member progress	- Clear and measurable reports on member progress
Trainer	1. Class scheduling	- Flexible and easy scheduling	- Customizable scheduling features to meet training needs
	2. Member progress reporting	- Difficulty in tracking member progress	- Easy access to member progress reports and training evaluations
Member	1. Information access	- Limited access to schedule and training program information	- Clear and accurate information system regarding gym services
	2. Online payments	- Potential errors in online payment process	- Secure, fast, and user-friendly online payment system

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Design and Implementation

In the design phase, the application architecture is designed while considering the principles of extreme programming (XP) methodology, which includes short iterations, continuous testing, and team collaboration. This architecture is designed to accommodate the needs of the membership management application efficiently and responsively to changes. Additionally, a development plan is formulated to include a feature backlog to be implemented in each development iteration. Priority is given to the most crucial features based on the needs of members and fitness center owners, ensuring that the application can provide significant added value according to user expectations and needs.

Subsequently, in the Implementation phase, the features planned in the application design are implemented according to the development plan. The development team collaborates to realize these features while adhering to XP principles such as clean code, continuous testing, and refactoring. This implementation process is carried out with a focus on the needs and expectations of fitness center owners and members, resulting in an application that is responsive, efficient, and meets user expectations. Assumptions and data used in this phase are based on the system requirements analysis and input from stakeholders related to the research topic.

Table 2. Features

Feature	Function
Membership Registration	Provides facilities for prospective members to register as new members
Member Profile Management	Allows members to manage and update their personal profiles
Class Scheduling	Provides class schedules and allows members to sign up for those classes
Payment Processing	Manages the payment process for membership fees, classes, and additional services
Progress Tracking	Monitors member progress in workouts and fitness goal achievements
Communication Tools	Provides communication facilities between members, trainers, and fitness center owners
Reporting and Analytics	Displays reports and analyses on member activities and fitness center performance
Membership Renewal and Cancellation	Facilitates the membership renewal or cancellation process for members
Equipment Reservation	Allows members to reserve workout equipment

Table 2 presents the features of the membership management application for fitness centers, which play a crucial role in enhancing member experience, optimizing fitness center operations, and ensuring customer satisfaction. Features such as member registration, profile management, class scheduling, payment processing, progress tracking, communication, reporting, membership renewal, and equipment reservation provide responsive, efficient, and

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member and fitness center owner-aligned services. With proper implementation, these features can assist in successfully achieving the membership management application's goals.

Figure 2 presents the Entity-Relationship Diagram (ERD) that reflects the structure and relationships between entities in the fitness center membership management application. Entities such as membership, classes, payments, goals, communication, reports, and equipment are interconnected through relationships described in the diagram. For instance, membership is related to classes through the "Registers" relationship, reflecting member registration for specific classes. Similarly, the "Tracks" relationship between membership and goals indicates tracking member exercise progress. This diagram provides a comprehensive view of how data and information flow among the entities involved in the application, enabling a better understanding of the operational and functional aspects of the fitness center membership management application.

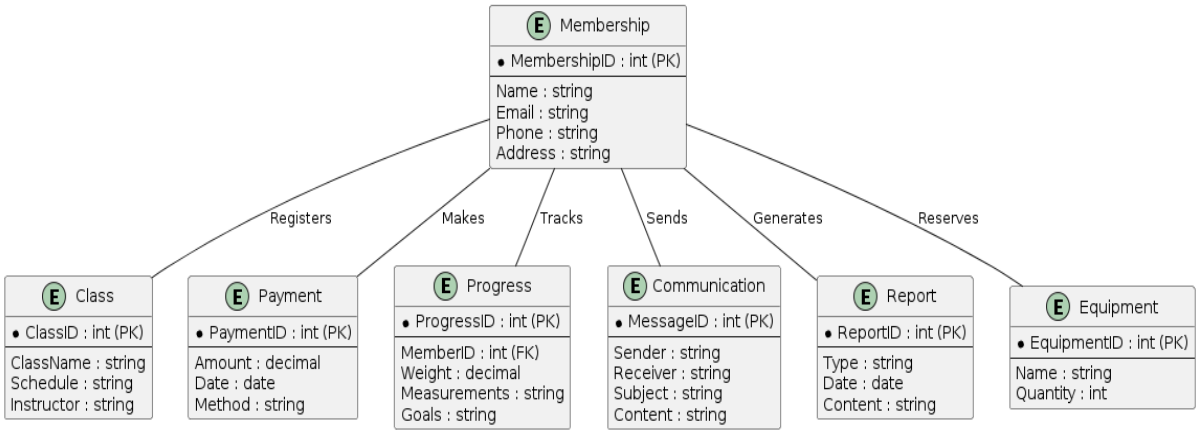

Figure 3. ERD

User Acceptance Evaluation

The testing phase begins with unit testing to ensure that each application component functions appropriately. This involves testing each feature and function in the application to ensure the absence of bugs or significant technical issues. Subsequently, application components are integrated for integration testing. This testing aims to ensure that the entire application runs smoothly and as expected, including the interconnection between various features and modules. After that, alpha testing involves an internal team consisting of developers, testers, and some fitness center team members. This testing aims to obtain initial feedback on the application before its public launch. Next, beta testing involves a group of fitness center members to test the application in a real-world environment. This testing helps identify any issues that may arise when real users actively use the application. Lastly, a comprehensive evaluation of application performance, member response, and membership management effectiveness using the application is conducted. This evaluation involves collecting input and feedback from users and other stakeholders to improve and enhance the application before its official launch.

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CONCLUSION

This research has produced a fitness center membership management application using Extreme Programming (XP) Methodology as the development approach. The research stages include system requirements analysis involving stakeholders, application design and implementation focusing on XP principles such as short iterations and continuous testing, and application testing and evaluation involving internal teams and fitness center members. As a result, this application successfully integrates essential features such as membership management, class scheduling, payments, member progress reporting, communication, and equipment reservations. Alpha and beta testing, performance evaluation, and member response also indicate that the application meets user expectations and enhances operational efficiency at the fitness center. Thus, this research significantly contributes to developing a responsive, efficient, and user-centered membership management application for fitness center owners and members.

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