Jurnal Ekonomi
Volume 13 , Number 02, 2024, DOI 10.54209/ekonomi.v13i02
ESSN 2721-9879 (Online)
https://ejournal.seaninstitute.or.id/index.php/Ekonomi

Development of Membership Management Application for Fitness Center using Extreme Programming Methodology

Denny Jean Cross Sihombing
Information System Study Program, Atma Jaya Catholic University of Indonesia

Article Info
Keywords:
Membership Management,
Extreme Programming,
Fitness Centers.

ABSTRACT
This study aims to develop a responsive and efficient membership management application for fitness centers using the Extreme Programming (XP) methodology. Challenges in managing memberships at fitness centers include complex registration processes, difficulty tracking payments, and inefficient member data management. The methods used include system requirements analysis involving stakeholders, application design and implementation using XP approaches such as short iterations and continuous testing, and testing 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 and member performance and responsiveness evaluations indicate that this application meets user expectations and enhances operational efficiency at fitness centers. This research contributes to providing a technological solution that improves membership management processes at fitness centers with a responsive and effective approach aligned with XP principles in software development.

Corresponding Author:
Denny Jean Cross Sihombing
Atma Jaya Catholic University of Indonesia
Jakarta, Indonesia
denny.jean@atmajaya.ac.id

INTRODUCTION

In the increasingly interconnected digital era, fitness centers have become focal points for individuals paying more attention to their health and fitness(Brandt et al., 2023; Fu et al., 2012; Javaid et al., 2022). The growing awareness of the importance of a healthy lifestyle and regular physical activity in society drives this phenomenon. Through social media platforms such as Instagram, TikTok, and YouTube, users share experiences and information about exercise, nutrition, and daily motivation, directly influencing the health-related interests and decisions of the general public(Cabitza et al., 2015; Das et al., 2021; Roberts et al., 2022a, 2022b; Wang & Conwell, 2022).

However, behind the increasing interest, there are complex challenges faced by fitness centers in managing and meeting the needs of their members. Manual processes in membership management often pose significant obstacles, including difficulties in timely payment

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processing, lack of adequate data integration, and insufficient member engagement in monitoring their progress. This affects the operational efficiency of fitness centers and can decrease member satisfaction and retention(Blocken et al., 2020; Cao et al., 2023; Eberth & Smith, 2010; Omitaomu et al., 2021; Samadbeik et al., 2023). Modern fitness applications have become vital solutions to improve membership management at fitness centers. Besides membership management, these applications can provide additional features that enhance member interaction and experience, such as class schedules, workout notifications, personal goal settings, and direct communication with trainers. With these applications, members can be more engaged and connected with their fitness centers, boosting motivation and consistency in exercising and health monitoring.

The Extreme Programming (XP) methodology offers an approach suitable for adaptive needs and responsive development in fitness application development(Akhtar et al., n.d.; Bansal et al., 2023; Chen et al., 2020; Fojtik, 2011; Sihombing, 2023; Wood et al., 2013). XP advocates short development cycles, continuous testing, and intensive collaboration among the development team, fitness center owners, and members. With XP adoption, fitness centers can produce applications responsive to changing member needs, enhance user experience, and improve overall membership management efficiency. In the XP context, one of the main advantages is the short development cycle(Alami et al., 2022; Al-Saqqa et al., 2020; Bomström et al., 2023; Gutierrez et al., 2019; Michalides et al., 2023; Serrador & Pinto, 2015). This allows the development team to quickly and effectively respond to changes in member requirements or needed improvements. For instance, if there are changes in membership policies or new feature requests from members, XP's short cycles enable the team to adjust the application promptly without sacrificing quality or efficiency. Continuous testing also becomes a vital aspect of the XP methodology. With a focus on ongoing automated and manual testing, the team can ensure that every change or addition of features in the application code is thoroughly tested. This helps identify bugs or functionality issues early on, allowing them to be addressed before compromising the user experience or fitness center operations.

In fitness center membership management, XP's short iterative cycles allow the team to respond more effectively to policy changes or member needs. For example, if there are changes in registration procedures or class scheduling, the team can make adjustments quickly and implement them in the next development cycle. This can reduce member confusion or dissatisfaction and improve operational efficiency. Intensive collaboration between developers, fitness center owners, trainers, and members also becomes a significant focus in developing XP membership management applications. The application can more accurately meet real needs and expectations by involving key stakeholders in the development process. Additionally, this collaboration allows continuous evaluation of the application, enabling it to be continuously improved and enhanced based on received feedback.

Overall, this study aims to integrate the advantages of XP methodology with the unique needs of fitness center membership management. Thus, the resulting application is expected to be a responsive, efficient solution that meets the expectations of both members and fitness

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center owners. This research is also expected to make a significant contribution to the development of user-oriented fitness applications that are adaptive to dynamic market and technological changes.

METHODS

The development stage of the fitness center membership management application using the Extreme Programming (XP) methodology includes system requirements analysis, application design, and implementation, as well as testing and evaluation. System requirements analysis is conducted to identify the core functionalities of the application based on the needs of members and fitness center owners through surveys and interviews. Subsequently, application architecture design is carried out considering XP principles such as short iterations and continuous testing, followed by prioritized features. Finally, the application is tested involving internal teams and fitness center members, followed by a performance evaluation and member feedback to ensure that the application meets user needs and expectations.

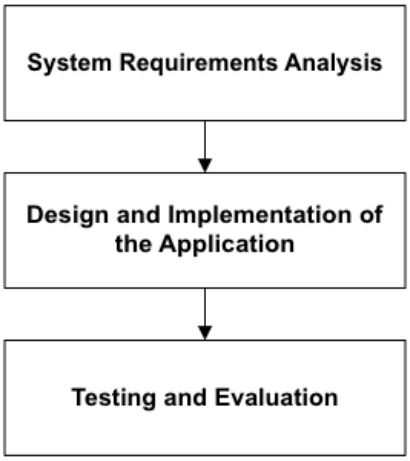

Figure 1. Research Stages

System Requirements Analysis

In the system requirements analysis phase, the core needs of the membership management application for fitness centers are identified. This process includes determining basic functionalities such as member data management, payment processing, class scheduling, and member progress reporting. Additionally, surveys and interviews are conducted with stakeholders such as fitness center owners, trainers, and members to understand their needs, preferences, and expectations for the application. The outcome of this phase is a requirements analysis document containing detailed functional and non-functional requirements, as well as mapping these requirements to the features to be implemented in the application.

Design and Implementation of the Application

Once the system requirements are identified, the next phase is the design and implementation of the application. In this phase, the application's architecture is designed considering the principles of the Extreme Programming (XP) methodology, such as short iterations,

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continuous testing, and team collaboration. Additionally, a development plan includes a backlog of features to implement each development iteration. Implementation prioritizes the most important features that provide significant value to members and fitness center owners.

Testing and Evaluation

The final phase in application development is testing and evaluation. Testing is conducted from unit testing to ensure that each application component functions properly to integration testing to ensure the entire application operates according to requirements. Alpha testing involves internal teams to obtain initial feedback, and beta testing involves fitness center members testing the application in a natural environment. Evaluation is performed on the application's performance, member responsiveness, and effectiveness of membership management using the application, considering input and suggestions from users and other stakeholders.

RESULTS AND DISCUSSION

User Needs Analysis

After identifying the core needs of the membership management application for fitness centers, the result is a deep understanding of the functionalities that should be included in the application, such as member data management, payment systems, class scheduling, and member progress reporting. Surveys and interviews conducted with fitness center owners, trainers, and members yield rich information about their needs and expectations for the application. The resulting requirements analysis document includes detailed functional and non-functional requirements and a mapping of these requirements to the features to be implemented in the application. The data collected from surveys and interviews provide a solid basis for guiding the application development process toward meeting user expectations and needs. Table 1 provides a more comprehensive overview of the core needs of each stakeholder in developing the membership management application for fitness centers. This includes critical requirements, challenges faced, and their hopes and desires for the application to be developed.

Table 1. Data Collection Results

Stakeholder	Key Needs	Addressed Challenges	Expectations and Desires
Gym Owner	Membership data management	- Streamlined registration process	- System capable of managing member data accurately and efficiently
	Payment system	- Reduced payment errors and tracking issues	- Easy payment processing and financial reporting
	Member progress reporting	- Structured assessment and evaluation of member progress	- Clear and measurable reports on member progress
Trainer	Class scheduling	- Flexible and easy scheduling	- Customizable scheduling features to meet training needs

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Stakeholder	Key Needs	Addressed Challenges	Expectations and Desires
Member	Member progress reporting	- Difficulty in tracking member progress	- Easy access to member progress reports and training evaluations
	Information access	- Limited access to schedule and training program information	- Clear and accurate information system regarding gym services
	Online payments	- Potential errors in online payment process	- Secure, fast, and user-friendly online payment system

Design and Implementation

In the Design phase, the application architecture is designed, considering the Extreme Programming (XP) methodology principles such as 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. A development plan is also drafted, including a backlog of features 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 value according to user expectations and needs.

Subsequently, in the Implementation phase, the planned features 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 aligned with user expectations. Assumptions and data used in this phase are based on the system requirements analysis and input from stakeholders associated with 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

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Feature	Function
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 within the membership management application for fitness centers that 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 member-centric services aligned with the needs of both members and fitness center owners. With proper implementation, these features can aid in successfully achieving the goals of the membership management application.

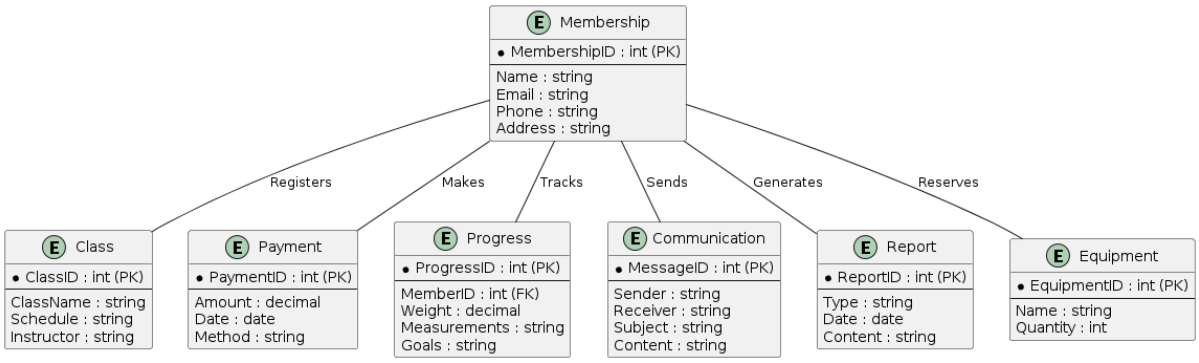

Figure 3. ERD

The ERD (Entity-Relationship Diagram) in Figure 2 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 example, membership is linked to classes through the "Registers" relationship, indicating member registration for specific classes. Similarly, the "Tracks" relationship between membership and goals signifies tracking of member progress in workouts. 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.

User Acceptance Evaluation

The testing phase begins with unit testing to ensure that each application component functions individually. This involves testing each feature and function within the application to ensure no significant bugs or technical issues. Subsequently, application components are integrated for integration testing. This testing aims to ensure that the entire application runs

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smoothly and as expected, including the interconnection between various features and modules. Afterward, alpha testing involves an internal team comprising developers, testers, and several members of the fitness center team. This testing aims to gather early feedback on the application before its public release. Next, beta testing involves a group of fitness center members to test the application in a real-world environment. This testing helps identify issues that may arise when real users actively use the application. Finally, a comprehensive evaluation of the application's performance, member response, and effectiveness of membership management using the application is conducted. This evaluation involves collecting input and suggestions from users and other stakeholders to improve and enhance the application before its official launch.

CONCLUSION

This research has produced a fitness center membership management application using Extreme Programming (XP) methodology as a 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 an internal team and fitness center members. As a result, the application has successfully integrated vital features such as membership management, class scheduling, payments, progress reporting for members, communication, and equipment reservations. Alpha and beta testing, as well as performance evaluation and member response, have shown that the application meets user expectations and improves the operational efficiency of the fitness center. Thus, this research significantly contributes to developing a responsive, efficient, and user-centric membership management application tailored to the needs of fitness center owners and members.

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