FitQuest: Applying Gamification in Fitness Through Motion Tracking Technology

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APPROVAL AND ACCEPTANCE SHEET

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API - Application Programming Interface

ISO - International Organization for Standardization

HRQol - Health Related Quality of Life

BMI – Body Mass Index

UX - User Experience

RAM - Random Access Memory

WIFI - Wireless Fidelity

XAMPP Cross-Platform, Apache, MySQL, PHP, and Perl

ERD - Entity Relationship Diagram

UI - User Interface

ABSTRACT

The objective of this study is to develop a web and mobile gamified fitness system named FitQuest, designed to revolutionize the fitness experience for gym goers and introduce an innovative reward system for gym owners. FitQuest integrates a rewards system to ensure sustained motivation among users, fostering regular participation in fitness activities. FitQuest incorporates engaging game elements, aiming to enhance user engagement and commitment.

Keywords: FitQuest, gamification, rewards system, motion tracking, motivation

Chapter 1

INTRODUCTION

The pursuit of fitness is a lifelong dedication, a path ventured by a select few who embrace the enduring commitment it demands. Central to this journey is the pivotal role of motivation. As the esteemed Joseph Pilates wisely asserted, "Physical fitness can neither be acquired by wishful thinking nor by outright purchase."

In the context of the Philippines, a concerning statistic emerges—nearly four out of 10 adult Filipinos find themselves contending with excess weight, making them susceptible to numerous ailments associated with obesity. Alarmingly, the prevalence of obesity in the country has witnessed a twofold increase among adults over the past decade, painting a worrisome portrait of the escalating health challenges confronted by the population.

In response to the concerning statistic, the researchers have undertaken the development of an innovative gamification-based web and mobile application titled "FitQuest." This application strategically converges the realms of fitness and gamification, presenting a solution to the motivational challenges inherent in the pursuit of physical well-being. FitQuest, briefly summarized, is a gamified system designed to incentivize and reward its users, thereby enhancing their engagement and commitment to the realm of fitness.

1.1.   Purpose and Description

The Philippines, a nation of over 100 million people, is becoming more health conscious. Despite this, not all are living an active lifestyle. In fact, a study from 2022 revealed that 73% of Filipinos do not have a gym membership. However, the fitness market in the Philippines is growing at a rapid rate. This growth is expected to continue, with gym memberships predicted to increase more as people are becoming more health conscious of their own bodies.

As more gyms are built in Metro Manila and the provinces, more Filipinos are joining the fitness club trend. Nearly a quarter of Filipinos held gym memberships in 2020, with 49% of club members visiting their neighborhood gym several times per week (Billitiz, 2022). This growing interest in fitness is not just seen in the physical world of gyms and fitness clubs. It has also spread to the digital world, especially on social media platforms.

Social media plays a big role in this trend. Many young individuals have started to go to the gym not for health, but for the aesthetic of having a good-looking body. This is largely driven by the desire to share fitness progress and aesthetically pleasing photos on social media platforms. The influence of fitness influencers and the popularity of the "fitspiration" trend among the younger generation cannot be underestimated. However, despite the growing gym culture and the influence of social media, there are still significant challenges that need to be addressed. One of the main issues is the lack of motivation among potential gym-goers. Many people start with a burst of enthusiasm, but this often fades due to a lack of discipline, a desire to see results instantly, or simply the difficulty of

maintaining a regular workout routine that leads them to quit after going just for a few weeks.

Moreover, the quality of gym facilities can also be a deterrent. Not all gyms are equipped with high-spec equipment, and this can affect the workout experience and results. Some gyms in less urban areas or with lower membership fees may not have the resources to invest in top-of-the-line equipment, which can be discouraging for those who are serious about their fitness goals.

1.2.   Project Context

In this generation, a health-conscious trend is gradually taking place. However, not all Filipinos are able to fully embrace this shift towards a healthier lifestyle. The primary problem is the lack of motivation that often leads to inconsistent exercise performance.

FitQuest, a gamified web and mobile fitness application system, designed to address this motivational gap, introduces gamification to fitness. The idea is to utilize motion tracking technologies to make workouts feel more rewarding. This is done by incorporating game elements, such as a reward system and point acquisition for users in every repetition of various exercise motions.

However, the challenges in the fitness landscape extend beyond individual motivation. Many gyms, particularly those in less urbanized areas, face issues related to the quality of

4 facilities and equipment. This can be a significant discouragement for those who are serious about their fitness goals.

Fishbone Diagram

This diagram identifies key challenges in the fitness industry, categorized under Materials, Man, Measurement, and Methods, and shows their interconnections. It highlights issues like lack of gym software, diverse preferences, insufficient user feedback, and unclear gamification strategies**.**
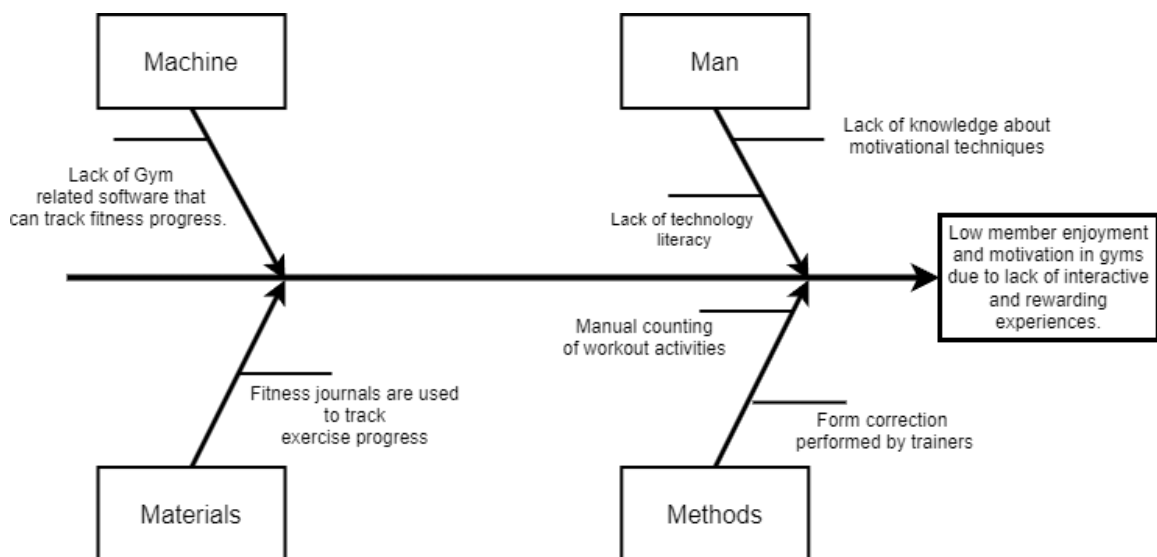
Figure 1. Fishbone Diagram

The fishbone diagram shows the potential causes for a lack of enjoyment and motivation of gym members. The main categories are lack of user feedback, lack of performance metrics, lack of technology integration, lack of technology literacy, and low member engagement and retention. The diagram also mentions specific examples of what might be

causing these problems, such as a lack of hardware that can track fitness progress, a lack of gym-related software, and a lack of clear strategies for implementing gamification.

1.3. General Objective

This project aims to design and develop a fitness-based web and mobile application system that incorporates gamification to improve motivation of gym members. Various features such as motion-tracking and reward systems will be included to promote motivation among users. The project also aims to conduct numerous tests to ensure the system works as intended by the researchers.

Specific Objectives

1. To incorporate motion tracking API within the application, which will be used to detect the user's exercise motions.

2. To incorporate a library of different exercise motions which will be used by the system as reference for correct and proper forms when exercising.

3. To design and develop a customizable reward system module and enable the administrator to set up the claimable rewards and its cost in terms of points.

4. To design and develop a weight progress monitoring module which will provide a visual representation of the user's weight progress and view a list of rewards that can be claimed.

5. To develop a BMI calculator module to inform the user of their BMI and classification (healthy, overweight, underweight).

6. To test the system using ISO 9126 to ensure the quality of the project is up to the international standard.

1.4. Scope and Delimitations

The incorporation of motion-tracking API within the application will be used to track the user's form and movement in a certain exercise of their choice. These exercises will come from a library of different exercise motions to promote proper form during a user's workout. Doing exercises properly in terms of form and motion can generate points for the users. These points can then be redeemed as rewards offered by the gym.

The Customizable Reward System module will be designed based on what the gym fitness center offers for the members of the gym as an incentive for their proper form and motion for various exercises. The module will require a certain amount of points for the members to claim their rewards. Integrating a progress tracking module that enables the members of the gym to have a visual representation of their weight progress, with the use of line graph for its easy-to-understand attribute.

The gamification aspect will be integrated from the motion tracking feature of the application by tracking the movement of the user via their camera. They would get points based on their form in the exercise they are performing. This is done by the motion tracker when it detects and determines the proper form of the exercise.

The core of FitQuest's mobile application is to gamify workouts and ensure users exercise with proper form. By tracking each movement via their smartphones, the app evaluates the user's form during repetitions and assigns rewards accordingly. For exercises requiring repetitions, maintaining good form earns rewards, while non-repetition exercises, such as planks, award points based on the duration a position is held. This system not only encourages correct exercise techniques but also enhances the workout experience through gamification. Currently, the mobile application contains a total of 12 exercises, grouped by the muscle group that involves each exercise. For upper body, push ups and shoulder taps are included. For core, crunches, standing oblique crunches, and high plank. For legs, squats, front, right and left lunges. For cardio, jumping jacks, skater hops, and ski lunges are implemented.

This project recognizes certain constraints that may affect the implementation and functionality of the FitQuest application. The system developed through this initiative will be exclusively available for Android platforms. It is important to note that features such as meal planning, achievement, and leaderboard modules will not be included in the current version of the system. The primary focus of this project is to develop an application that employs gamification techniques to enhance user motivation and promote consistency in exercising.

The development of the application relies heavily on an external API called Sency Motion. Because of this, certain limitations may be encountered during development. One of which is the API's ability to provide real time form correction during an exercise.

However, Sency Motion is getting further updates which will address these issues in the near future.

ISO 9126 will be utilized by the researchers to test the system's overall performance and quality. The specific parts of this standard will include Functionality, Usability, Reliability, Portability, Supportability to ensure the system performs its requirements.

1.5.   Conceptual Framework
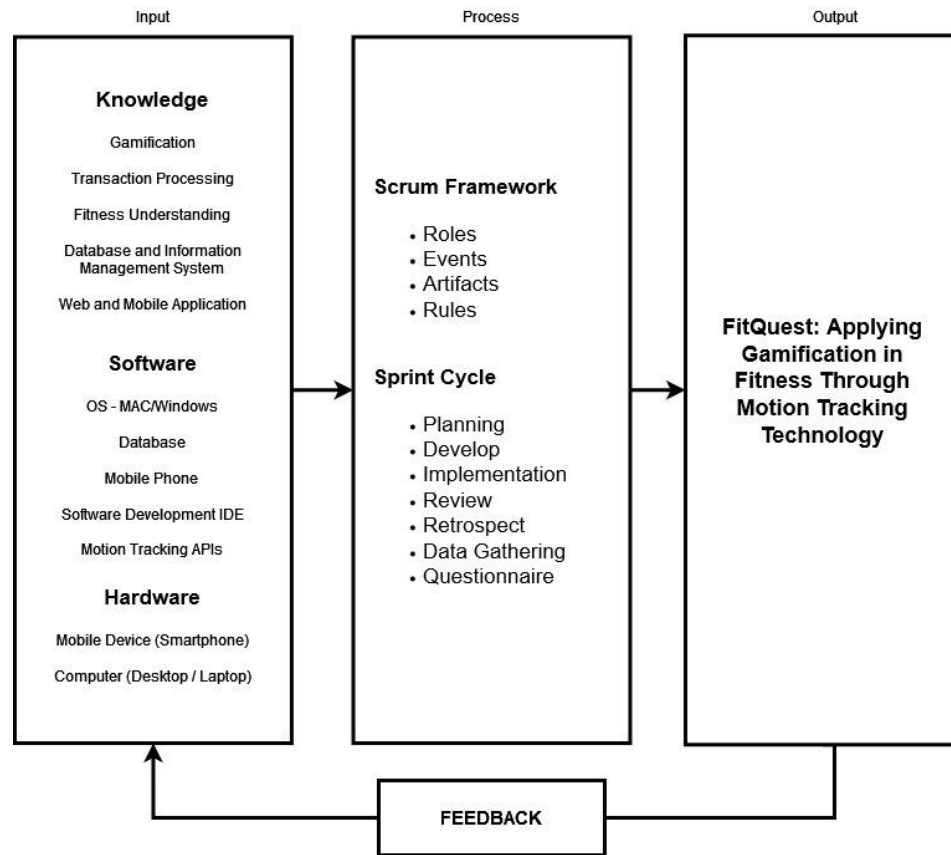
Figure 2. Conceptual Framework

This model outlines the system's components, including knowledge of gamification, fitness, and motion tracking technology; necessary software and hardware; and the processes involved in transaction processing, database management, web and mobile application development, all managed within a Scrum framework. The output is the FitQuest system itself, designed to motivate users through gamification and motion tracking.

1.6. Significance of the Study

The aim of this study is to develop a web and mobile application that is integrated with rewards system to incentivize the users' interaction with the system. The concept of applying gamification in workouts is to improve and keep the interest of the users and promote physical activity. The proposed system will be beneficial to the following:

Gym Members - The project can benefit gym goers in terms of boosting motivation levels when exercising. This can increase consistency which will lead to a better physical health and overall experience when exercising.

Gym Establishments - The system promotes memberships for customers which can lead to an increase in revenue.

Future researchers - The project is meant to grow and improve as technology progresses so that future researchers who aim to improve gym processes can utilize the findings from the study as reference for their projects.

1.7. Definition of Terms

Technical Terms:

APIs (Application Programming Interfaces) – Facilitate data exchange between mobile and web apps.

Cross-Platform Compatibility Testing – Makes sure FitQuest works smoothly on different devices like phones and computers.

Reward System – Assigns points for fitness achievements, leading to gym rewards.

Points System – Quantifies user fitness progress for reward determination.

Web Application – Online platform for FitQuest accessible on various devices.

Mobile Application – Software designed to run on mobile devices such as smartphones and tablets.

Feedback Module - Component enabling user comments and suggestions for application improvement.

Motion Tracking - Technology monitoring and recording body movements during exercise for performance tracking and improvement.

Progress Monitoring - Tracking and evaluating user advancement in fitness goals over time.

ISO 9126 - An international standard specifying criteria and guidelines for evaluating the quality of software products based on attributes such as functionality, reliability, usability, efficiency, maintainability, and portability.

Operational Terms:

Gamification – Adding game-like elements for engagement and motivation.

app for smartphones with challenges and progress tracking.

Responsive Design – Makes sure the website looks good and works well no matter

what device you're using.

User Account Management – Keeping your account safe when you sign up and use

the app.

Chapter 2

REVIEW OF RELATED LITERATURE

Related literature and studies can significantly support the ideas and arguments written in research. In the context of FitQuest, the following are utilized as informative materials that support and justify the creation of the system. Related systems are also included in this chapter, which can serve as guidance when comparing and implementing various features to FitQuest. Overall, this chapter presents literary works, academic studies and related systems to support the development of FitQuest.

2.1. Related Foreign Literature

2.1.1 The Role of Motivation in Fitness

Motivation is known to play a great role in a person's fitness journey. It can determine one's dedication to consistently exercise and achieve fitness goals. An article written by Riiser et al. (2014), states that motivation directly correlates to cardiorespiratory fitness or CRF and health-related quality of life or HRQol. The statement was proven by utilizing self-report instruments with the purpose of measuring the HRQol of participants, which consisted of one hundred twenty adolescents which are considered to be overweight or obese. Confirmatory factor analysis was also conducted to determine the hypothesized five-dimensional structure of the Behavioural Regulation. This analysis was used to measure self-

determined motivation. The article proved that an individual's motivation can greatly help them be consistent in exercising and thus increase their chances of improving their health-related quality of life.

2.1.2. Using Gamification to Boost Motivation

The main objective of the project is to boost user motivation by utilizing the principles of gamification. Essentially, gamification is the utilization of game elements in non-game context. The ideas and mechanics of gamification is versatile, in that it can be used in many contexts. Naturally, utilizing gamification means using game elements such as points, levels, leaderboards, reward systems and many more. These elements, if used effectively, can garner extrinsic motivation. Extrinsic motivation is defined as performance of an activity in order to attain a desired outcome. In contrast, intrinsic motivation is defined as a selfdesire to seek out new things and new challenges, to analyze one's capacity, to observe, and to gain knowledge. According to an article written by Boulet (2016), however, research shows that regular users of gamified systems are mainly intrinsically motivated to use these systems. Meaning these users are motivated because of their self-desire, in other words, motivated intrinsically.

2.1.3. Using Gamification in Fitness

The philosophy of gamification is that it can make activities more enjoyable by incorporating game elements as a factor when doing activities, hence its name. Like in every other activity, this philosophy is also effective in fitness. As Paul

(2023) writes in his article, gamification can not only help inspire users to exercise more, it can also help them have fun while doing it. This phenomenon is due to the rewards system associated with gamification. Paul states that correctly applying gamification can greatly enhance the motivation of users. By setting goals and 14 achieving them, a sense of accomplishment can be felt by users. Thus, causing them to stay consistent in their fitness journey. The same article states that players who are motivated by game-like elements tend to be more likely than non-players' counterparts to stay healthy outside the confines of their digital context. Which essentially means engaging in gamification can grant psychological benefits as well, even outside the context of the gamified system itself.

2.1.4. Global Obesity Rates Increasing

In a global setting, obesity has always been known as a common health problem. In spite of this, cases of obesity continue to rise globally. This health problem was first thought of as a common problem among developed countries exclusively. However, recent data shows that obesity is also prevalent in third world countries. It is even more concerning to know that this health problem grows exponentially. An article written by Kluger (2023), explains that cases of obesity will continue to rise and will be doubled by the year 2035. The data gathered from this article comes from the World Obesity Atlas (WOA) which specifically states that more than half of the population, specifically 51% or four billion people will be obese by 2035. To treat obesity related illnesses during that time is estimated to

cost four trillion dollars annually, which makes the disease devastating even in the context of finance.

2.1.5. Gym Culture Defined

The world of fitness is bound to constantly affect society's perception of the ideal physique. The main idea behind gym culture stems from the values of gym goers in the current era. An article by WNiF Writing Team (2023), explained the evolutionary timeline of gym culture, stating that slimmer and toner physiques are more desired in our current decade. The article also mentions the impact of social media on gym culture, specifying the trend of aesthetics when it comes to physiques. This trend has led gym environments and gym goers to become more image-conscious, which emphasizes the desire for a visually perfect body. The article also mentions the impacts of the COVID-19 pandemic to gym culture, stating that gym closures had shifted a trend towards home workouts, which made gym establishments adapt by enhancing their online presence and offering virtual classes.

1.8.   Related Foreign Studies

2.2.1. Principles of Gamification

Gamification, at its core, is essentially utilizing game elements, such as incentives, competitions and reward systems to produce a sense of enjoyment out of an activity that is otherwise tedious to do. A study by Robson et al. (2015), says

that gamification is the application of lessons from the domain of gaming in nongame situations, which prompts individuals to harbor a pattern of behaviors. In the context of a company which focuses on business processes like customer acquisition or sales, an employee can be motivated to focus more on their duties by 16 providing them with incentives each time they succeed. This rewarding system reinforces positive emotions which encourages behaviors to be repeated, similar to the law of operant conditioning. In other words, gamification can modify an individual's behavior. This can lead to an increase in motivation to do activities that can be considered tedious otherwise. In the context of this project, gamification will be used to motivate the target users to stay consistent when exercising.

2.2.2. Impacts of Gamification on the Fitness Industry

Gamification is relatively a new concept and integrating it will affect several factors in the fitness industry. According to Ozdamli and Milrich (2023), there are positive impacts of gamification and one of those is it became a helpful aid for motivating and imposing a healthy and active lifestyle for people of all ages. It is also said that gamification features, such as scores and leaderboards, helps the user to be motivated as they develop the sense of achievement that enables them to be encouraged and give themselves another go to do more that will give them healthier and productive habits. Despite the positive impacts of gamification in the fitness industry, a major downside is getting the users to act in accordance because no matter how good the impact is in the industry, if the user is reluctant, the gamification does not matter.

2.2.3. Exercise Applications as the Bridge for Gamification

In order to implement gamification in the project, an exercise application is an essential foundation. This software will be used as the main method for the users to engage with the system. A study by Kari et al. (2016), suggests that exercise applications can be effective in boosting user motivation in the context of exercising. Such results became evident after qualitative interviews were conducted. Participants in the study used an exercise application known as "Suunto Movescount", which is no longer available as of 2023. Kari's team found out from their interviews that participants were evidently more motivated to exercise just by using the application. The application is said to have features such as progress tracking and calorie counters, which helped users be more engaged with their physical progress, thus boosting their motivation.

Figure 3: Suunto Movescount Application (Unavailable as of 2024)

2.2.4. The Moderating Role of Commensurability of the Game Elements

As application firms move towards gamifying the development of their applications to make it more engaging for the users to keep using their apps. Gamification's effectiveness is lessened by types of game elements such as commensurate and incommensurate elements (Feng, 2020). Commensurate elements are the game elements that are in-line with the performance of the users such as steps tracker that can be distinguished as users outward motivation to their efforts. Conversely, incommensurate elements are those found in applications that meet users' psychological requirements without having any bearing on how well a player performs; one prominent example of this is the "like" element. With all these game elements, it is shown that using incommensurate elements for gamification of an application can be a better aid in growing innate motivation, engagement, and 19 time-usage than using commensurate elements.

2.2.5. Gamification From the Perspective of Self-Determination Theory and Flow

Recent studies by Jung et al. (2010) and Mekler et al. (2013) explore the use of game elements in non-game environments to boost desired behaviors. While findings suggest positive impacts, the long-term effects and comprehensive gamified systems are still under investigation. External rewards, such as points and badges, may influence intrinsic motivation, but the results are varied. Considerations of personal factors, situational aspects, and broader contexts are vital for effective gamification. Tailoring designs to users and understanding their

initial motivations require further exploration. In essence, successful gamification hinges on thoughtful design, aligning with psychological needs, and incorporating principles from flow theory.

2.3. Related Local Literature

2.3.1. Obesity in the Philippines

Obesity, which is considered to be a critical health concern by the World Health Organization (WHO), is prevalent in the Philippines. A statistic from Philstar states that 36.6 percent of adults in the Philippines are overweight or obese, meaning their BMI (Body Mass Index) reaches a score higher than 25. Additionally, an article 20 from NNC (National Nutrition Council) (2022), explains that cases of overweight and obese individuals have doubled in the past twenty years in the country. The same article says that the trend continues to be more common as time goes by. This means that an external factor is needed to stop the spread of obesity in the country. Regrettably, the case for adolescents in the Philippines seems to be on the same track. Results from Landscape Analysis on Overweight and Obesity in Children anticipates that over 30% of Filipino adolescents will be overweight or obese.

2.3.2. Using Gamification in a Filipino History Class

Class participation can be vital in a classroom setting. It can ensure students are engaged and are listening to the discussion. However, it can sometimes be

difficult to keep the student's attention for a long period of time. Gamification, however, can provide enjoyment for the students. An article by Alvarez (2023) discusses how gamification can be implemented in an online class setting to successfully promote participation. Alvarez stated, in the context of a history class, that different games such as role-play and simulation can offer many benefits, including promotion of participation, sense of belonging and community building. The article emphasizes that a variety of games can be put into consideration, including board games. The most important factor to consider is that the game should focus on class content and that gamification works very successfully in online class settings.

2.3.3. How Needs Affect Filipino Motivation

Motivation often comes from an individual's needs. These needs may include financial aid, health, social and among other things. In a third world country like the Philippines however, many citizens are motivated by their financial needs. Due to this, these citizens are extremely motivated to work and provide financial stability for themselves and their families. An article written by Ilagan et al. (2014), stated that investigations have found that Filipinos are especially motivated to work due to their collectivist nature. Most Filipinos have family-oriented values, which can motivate them to work and gain financial stability. Filipinos also tend to emphasize their personal need for career satisfaction, which can also lead to a high motivation to work. The article also provided insights that can benefit employers,

including one about employee engagement. The article mentions that employers can design employee benefits in a way that also benefits the employee's families. This implementation can boost the motivation of workers and improve the job offering process of the company.

2.3.4. Other Motivational Strategies

Aside from Gamification, other motivational strategies exist, especially in the academic field. In the context of the academe, these motivational strategies are utilized to boost student participation and engagement. An article written by Guadaña (2020), explained that out of forty-eight motivation strategies, only eighteen strategies are used by English teachers in the Philippines. This means that 22 the employment of existing strategies is not yet fully explored, as there is more to be utilized. The article further explained that out of the eighteen strategies, most were found to be confidence boosting for the learners. This explains that boosting the confidence of participants can directly boost their motivation as well. The article also emphasizes that teachers should think about their approach to teaching and consider utilizing motivational strategies to encourage their student's participation in the classroom.

2.3.5. Motivational Tactics of Notable Filipino Athletes

The Philippines is home to some of the world's greatest athletes. These notable figures include Manny Pacquiao, Hidilyn Diaz., Ian Lariba and many more. In order to become as great as these individuals, one must be extremely motivated to train and persevere. An article written by Lo (2018), explained that exemplary athletes like the ones mentioned employ different motivational tactics to continue their hard work and dedication. These tactics include rigorous training regimens, mental fortitude to overcome challenges, strategic planning to achieve their goals, and maintaining a healthy balance between their professional and personal lives. By employing these tactics, the athletes can continue working as hard as they can, whether in training or in the middle of their match. The article further emphasizes that these individuals are more than just talented, they are also extremely hardworking and disciplined. Maintaining traits such as discipline and resilience requires tremendous amounts of motivation, which is why motivational tactics are employed by the athletes.

2.4. Related Local Studies

2.4.1. Gamification in Academics in the Philippines

The presence of gamification is traditionally seen in many schools and institutes of learning. Applications such as "Kahoot!" are a great example of blending game elements into the context of a learning environment. Schools in the Philippines also advocate the use of such applications. A study conducted by

Tolentino et al. (2019) uses the methods of gamification in the context of teaching physics to high school students. The study revealed that the utilization of gamification increased the students' career motivation, grade motivation and self efficacy. The study further suggests that while gamification causes positive effects on some aspects of student motivation, care should be exercised when incorporating gamification elements to a classroom setting.

2.4.2. Gamification and Learners' Motivation in the New Normal

The COVID-19 outbreak presented the Philippines with hitherto unheard-of challenges. The nation needed to come up with innovative solutions to deal with the challenges of keeping students motivated in the face of disruptions to traditional education in order to guarantee ongoing involvement and learning. A student's motivation to learn has a significant impact on their academic achievement in the classroom. Lebuna et al. (2022) conducted a study regarding dominant gamification strategies used by college instructors and the extent of utilization in this new 24 normal. The study shows that Kahoot, Quizlet, and Quizizz are the three major gamified applications that the instructors used. It is also revealed that students are highly motivated to learn using this gamification strategies and there's a moderate positive correlation between the utilization of gamification strategies and learners' level of motivation.

2.4.3. Exercise Motives of Filipinos

The people of the Philippines are known to be hardworking and industrious. However, this is not a sufficient answer for finding out the motives to exercise for

most Filipinos. A study by Cagas et al. (2014), investigated this specific inquiry and found out various common motives for Filipino individuals to exercise. In the study, Cagas et al. found out using open-ended methodology to gather data, that Filipinos find motivation to exercise from their desire to lose weight, which could be caused by a desire to look thinner, and a strong desire to look and be stronger, as well as other positive health benefits. However, social and personal accomplishments like recognition, challenge, and competition were least cited. This means that Filipinos are least motivated by social aspects of exercising. Despite this however, some Filipinos are reported to be motivated to exercise due to the social pressure and influence from their family and peers.

2.4.4. Fitness Status of Faculty and Employees

Non-communicable diseases have been continuously growing everywhere due 25 to lack of physical activities of an individual around the world. Ischemic heart disease and stroke are two major causes of death across the globe with a combined 15 million deaths in 2015 (WHO, 2017). Cruz et al. (2020) conducted a study that is aimed to check the fitness status of PUP administrative employees and faculty members. The results show that overweight, high blood pressure, and dizziness are the most common symptoms experienced by the respondents of the study. Additionally, most of the respondents do not have a good fitness performance which leads them to having poor cardio-respiratory fitness, muscular strength and endurance. Therefore, the researchers suggest that the university

should create a department that's responsible for making a suitable health and skill-related development program for their faculty members and employees.

2.4.5. Preferences of Gym-Goers in the Philippines

In order to find out what can and cannot work when building a reward system tailored for a gym environment, it is important to evaluate the preferences of gymgoers, since they will be the primary users of the system. A study by Ong et al. (2021), conducted a conjoint analysis approach to evaluate gym-goers' preferences in the Philippines during the pandemic. The study identified key attributes that influence the choices of the gym-goers, including price, ventilation, service, trainer, payment method, operating hours and login procedures. The study made it evident that gym-goers will mostly base their choice of fitness establishments on price. Economic constraints during the pandemic may contribute to this preference. Furthermore, Ong et al. stated that gym-goers will prefer to exercise in well- 26 ventilated and air-conditioned environments, highlighting their preference for comfort. The study concluded that gyms need to adapt by balancing cost-effectiveness with enhanced safety and service quality to remain sustainable and appealing to consumers in the pandemic context.

2.5. Related Systems

2.5.1. FIAS: Fit In A Second

FIAS, a gym application made by Egana et al (2018). operates similarly to some of FitQuest's goals. The application mainly focused on the management aspect of a gym application with additional features such as progress tracking and production of meal plans. The research team of FIAS strived to promote efficiency in their project, conducting numerous testings and keeping user experience a priority in their production. The team also utilized expert guidance from dieticians in order to provide accurate meal plans for users. FIAS was also created as a specialized application that is implemented in Gold's Gym, an American gym franchise that also exists in the Philippines. FIAS was reported to be successful in reaching its objectives. However, the team behind the project suggested finding ways to monitor the user's vitals to ensure they are not overexerting themselves and to adding additional workout categories that could be made specifically for entertaining children and elder users, which is similar to a gamified experience.

2.5.2. LUID Language Revival: Kapampangan Gamification App

LUID, a learning application created by Gonzales et al. (2023), can be related to some of FitQuest's objectives. The application addresses the revival of languages in the Philippines, specifically, the Kapampangan language. Its aim is to develop a gamified language learning application using spaced repetition algorithms, specifically the Leitner System and SuperMemo algorithm, to revitalize

and preserve the language. In Luid, you guide the protagonist in his small journey of going to his province, for the first time as you join him learn the abundant culture and language of Pampanga. Some of the game's features are different levels and challenges that can motivate the user to learn the language. FitQuest however, will implement a reward system in the form of points which can then be used by players to claim different gym equipment, supplements, or meetings with personal trainers as long as they have the points equivalent to that of the reward they want to claim.

2.5.3. Gymification - Inducing Intrinsic Motivation through a Gamified Gym Application

Gymification, an innovative application developed by Picone et al. (2019) stands as a related system resonating with FitQuest's objectives. Positioned as the medium of gamification and motivation, Gymification strategically taps into the realm of literature recognizing gamification as a potent motivator (Hamari, Koivisto & Sarsa, 2014) This application essentially transforms the workout experience into a gamified adventure. 28 In simpler terms, Gymification is like your workout buddy, making exercise feel like a game. It incorporates game elements, such as points and challenges, to add a fun twist to your fitness routine. However, the literature has debates on how effective these game elements really are (Richter, Raban & Rafaeli, 2015; Seaborn & Fels, 2015) Gymification believes on the idea that turning exercise into a game can be a powerful motivator, offering users a playful fitness coach right on their devices.

2.5.4. Go Active!: A Gamified Gym Application by BRP Systems

"Go Active!" is a gym application developed by BRP Systems that runs some of FitQuest's goals and objectives. The application mainly focuses on booking classes depending on what the gym has to offer to their customers and it monitors the frequency of the users' training. It aims to increase gym members' engagement and motivation when using the application by using gamification features. The development team behind the "Go Active!" utilizes gamified elements such as experience points and monthly coupons as the application's reward system to give the user both long-term and short-term rewards.

2.5.5. UX Analysis: A Workout Application Focusing on Elements of User Experience and Gamification

"PushApp" is developed by Carlsson et al. (2018) stands out as a significant exploration of user experience (UX) and gamification within workout applications. 29 The study delves into the difference of user interactions and motivational factors, presenting valuable insights that can inform and enhance the development of FitQuest. The core focus of "PushApp" lies in crafting an immersive UX, emphasizing interface design, navigation, and accessibility. This research aligns seamlessly with FitQuest's commitment to creating a user-friendly platform, emphasizing the importance of understanding and enhancing user adherence for a successful fitness application. Additionally, "PushApp" incorporates gamification

elements, such as achievement badges and challenges, to boost user engagement. The research investigates how these gamified features contribute to overall success, providing relevant parallels for FitQuest's goal of motivating individuals to embrace physical activities through dynamic and enjoyable experiences.

Figure 4: Advertisement for PushApp

The advertisement highlights the app's gamified features, such as achievement badges and challenges, which aim to boost user engagement. The research discussed in your thesis investigates how these gamified elements contribute to overall success and provides relevant parallels for FitQuest's goal of motivating individuals to embrace physical activities through dynamic and enjoyable experiences
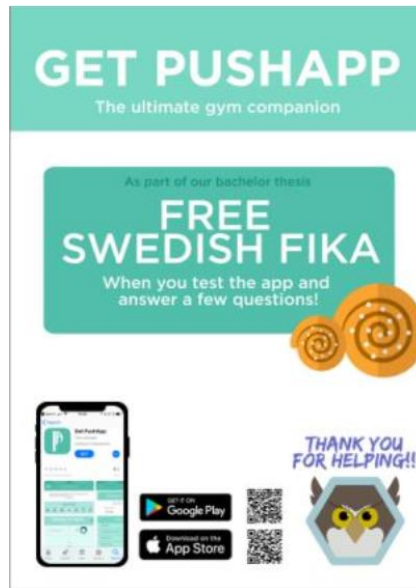
2.6. Synthesis

The literature review dwells into the critical components of fitness, focusing on motivation, gamification and with direct implications for the FitQuest project. The importance of motivation becomes clear, particularly in how it directly impacts fitness and overall quality of life. Consistent exercise linked to an individual's 31 motivation is highlighted as a key factor in improving overall well-being. Gamification is understood as a versatile strategy and emerges as a tool to make physical activities enjoyable, showcasing its potential to boost intrinsic motivation and encourage users to stay committed to their fitness goals.

The alarming global rise in obesity rates is emphasizing the urgency for interventions like FitQuest. Understanding the specific motivational factors driving Filipinos, such as financial needs, becomes crucial. Additionally, preferences of gym-goers in the Philippines reveal key considerations like price and comfort, which can inform FitQuest's approach in creating a reward system appropriate to user needs. The fitness status of faculty and employees emphasizes prevalent health issues, providing insights for FitQuest to develop health programs for a diverse demographic.

In essence, FitQuest's success lies in understanding what motivates individuals, applying gamification effectively, and appreciating cultural nuances. Crafting motivational strategies that align with diverse cultural factors, incorporating effective gamification elements, and staying informed about global health trends will strengthen FitQuest's impact. Recognizing the importance of a user-friendly interface, as suggested by studies like "PushApp" underscores the need for a smooth and enjoyable platform for sustained

user engagement. In summary, the synthesis outlines a practical roadmap for FitQuest, emphasizing the integration of motivational and gamification strategies tailored to a diverse audience, mindful of global health challenges.

Feature Matrix

This feature matrix compares six fitness apps across five features, indicating the presence or absence of each feature

Features	FitQuest	FIAS	LUID	Gymification	Go Active!	PushApp
Gamification	✅	❌	✅	✅	✅	✅
Reward System	✅	❌	❌	❌	✅	❌
Progress Tracking	✅	✅	✅	✅	✅	✅
Web Support	✅	❌	❌	❌	❌	❌
Motion Tracking	✅	❌	❌	❌	❌	❌

Figure 5: Feature Matrix

The matrix evaluates the presence or absence of five key features: gamification, reward system, progress tracking, web support, and meal planning. This comparison provides a clear overview of the feature set of each app, allowing for a comparative analysis of FitQuest's strengths and weaknesses in the competitive landscape.

Chapter 3

METHODOLOGY

In this chapter, the researcher's methodology is outlined, which is used to investigate and communicate the procedures done in developing FitQuest. Given the nature of the team's inquiry, both qualitative and quantitative methods were deemed most appropriate. This facilitates a comprehensive analysis of creating a gamified gym management system. This methodological framework serves to ensure the reliability and effectiveness of FitQuest.

3.1. Requirement Analysis

This section ensures the development of FitQuest is aligned with user needs and the researcher's goals. The aim of requirement analysis is to establish the foundation for the design and development phases, which makes it a critical initial phase of Chapter 3. The team employs data gathering procedures such as interviews and document analysis to capture a holistic view of the functional and non-functional requirements that are essential for the development of FitQuest. The data gathered from these procedures are translated to tables and diagrams to communicate and support the technical specifications and implementation strategies that will be used by the researcher's.

Operational Feasibility

This section outlines the different modules of the system. These modules are aligned with the specific objectives and requirements of the system.
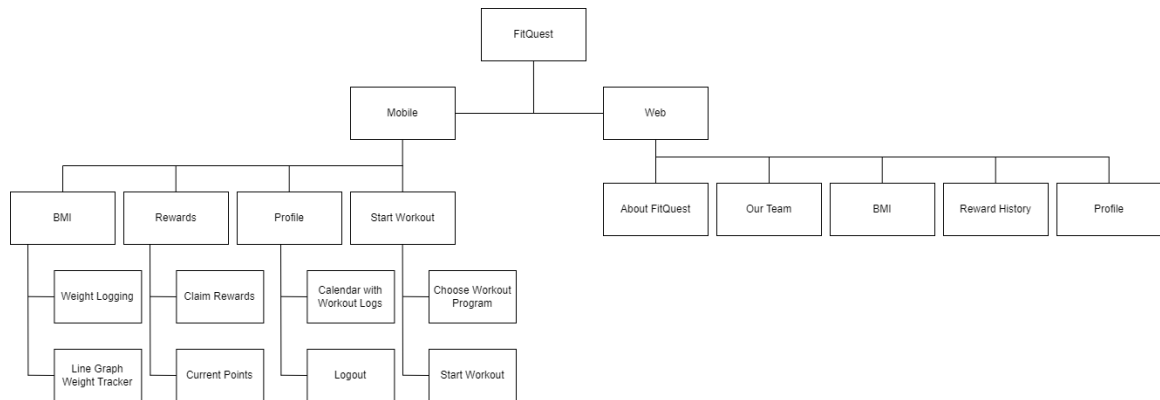

Figure 6: Functional Decomposition Diagram (Gym Member-side)

The figure above depicts the functional decomposition diagram for the Gym Member-side of the FitQuest application. This diagram breaks down the various features and functionalities available to gym members, highlighting the two main platforms: Mobile and Web. On the Mobile side, key functionalities include BMI tracking, accessing rewards, managing profiles, and starting workouts. These are further decomposed into sub-functions such as weight logging, claiming rewards, and choosing workout programs. The Web side mirrors some of these functionalities, offering options like learning about FitQuest, viewing team information, checking BMI, reviewing reward history, and managing profiles.
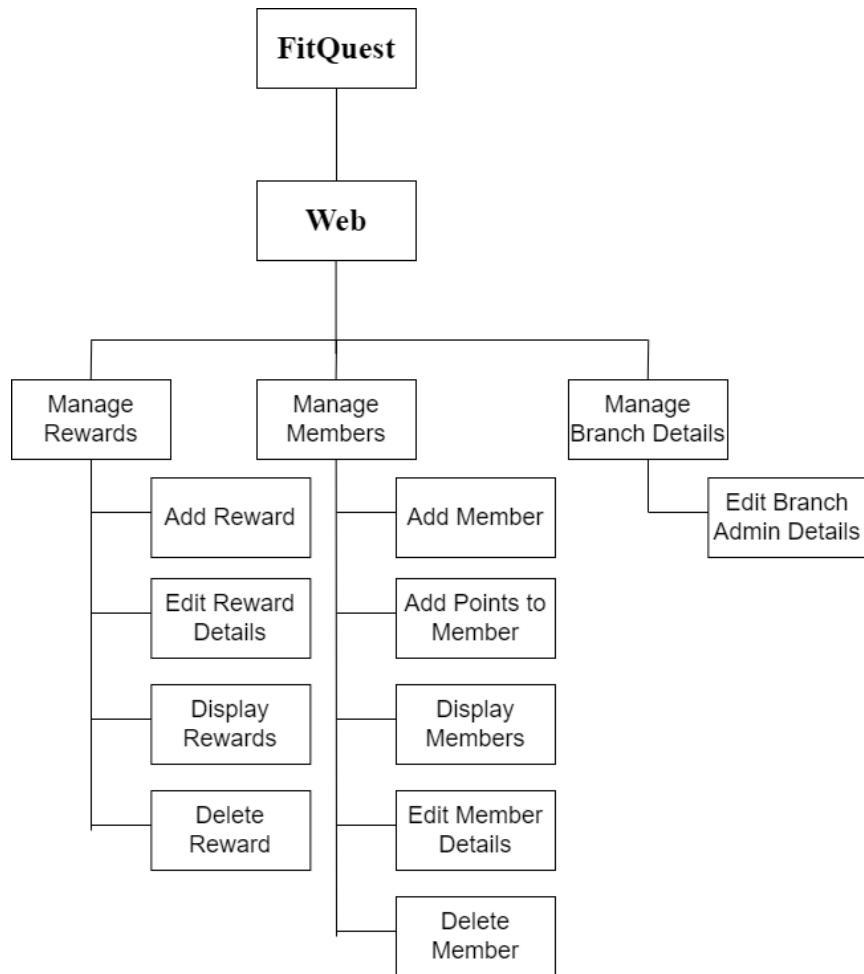
Figure 7: Functional Decomposition Diagram (Admin-side)

The system is divided into three primary modules: Manage Rewards, Manage Members and Manage Branch Details. The Manage Rewards module encompasses functionalities for adding, editing, displaying, and deleting rewards. Similarly, the Manage Members module handles tasks related to adding, modifying, displaying, and removing members, including the ability to add points to a specific member's account. The Manage Branch Details encompasses editing the branch information as well as the Admin of the particular branch.

Technical Feasibility

Table 1. Hardware Requirements

Components	Requirement
Developers	Computer or laptop with: • GTX 1660 Super • 12GB RAM • Ryzen 5 5600x • At least 1TB SSD/HDD
	Mobile (Test and Debug) • At least Android 13 • 4 GB RAM • 2 GHz Processor
	Internet • Wi-Fi • Ethernet
End-Users	Mobile • At least Android 13 • 4 GB RAM • 2 GHz Processor
	Computer or laptop with: • GTX 440 • 8GB RAM

	• i3-3220
	Internet • Wi-Fi • Ethernet

Table 1 shows the components needed in developing the program. The system must have the proper hardware stated above to be able to function with the requirements in making the system. Personal computers and/or laptops will be used in the development of the system and testing for the web interface. On the other hand, smartphones are needed to test the application and to discover the possible errors and bugs. An internet connection is also needed for the system to work for web and mobile applications. End-users also need the requirement specification of the hardware to be able to use the application.

Table 2. Software Requirements

Components	Requirements
Developers	- Windows - Internet Browser - XAMPP - Android Studio - Hostinger - Google Firebase
End-user	- Windows or any operating system - Internet Browser

Table 2 shows the software requirements needed in developing the program. The system must have the proper software stated above to be able to function with the requirements in making the system. Personal computers and/or laptops will be used in the development of the system and testing the web interface. On the other hand, smartphones are needed to test the application and to discover the possible errors and bugs. An internet connection is also needed for the system to work for web and mobile applications. End-users also need the requirement specification of the software to be able to use the application.

Schedule Feasibility

This section states the project's feasibility in terms of time and schedule. The Gantt chart will be used to visually present the researchers tasks chronologically.
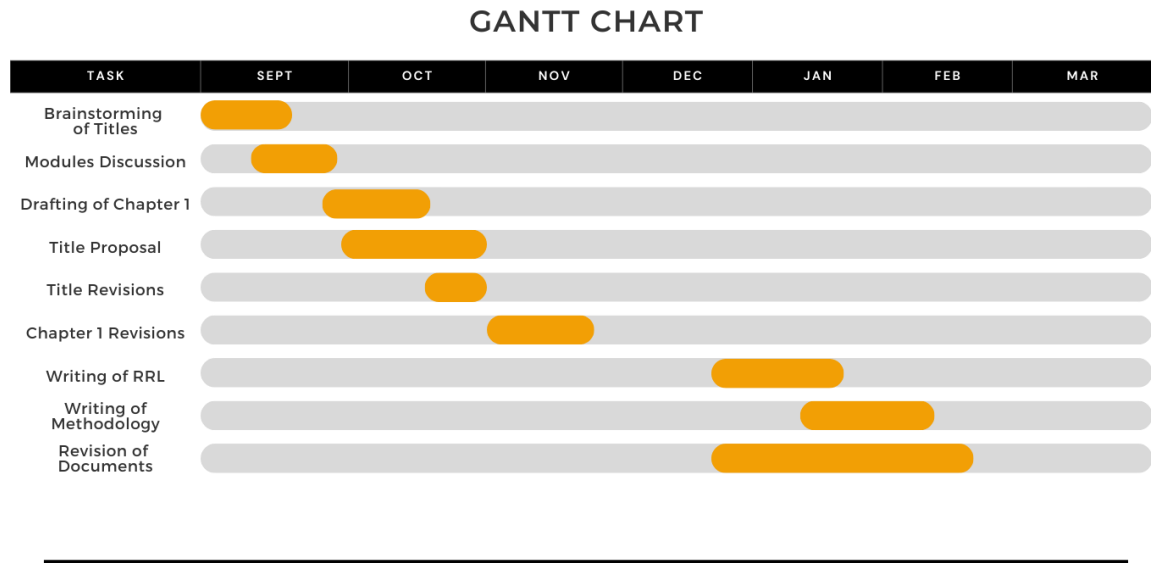

GANTT CHART

TASK	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
Brainstorming of Titles							
Modules Discussion							
Drafting of Chapter 1							
Title Proposal							
Title Revisions							
Chapter 1 Revisions							
Writing of RRL							
Writing of Methodology							
Revision of Documents							

Figure 8. Gantt Chart

The Gantt Chart is used for planning and scheduling projects. It serves as a guide for the completed tasks during the development of the system. By using this chart, anyone can monitor and check the requirements that need to be submitted.

Economic Feasibility

Table 3. Development Costs

Equipment	Cost
Hostinger Web Hosting	1789 PHP per year

- Tangible Benefits:

  o Better Overall Physical Health - Users who are engaged and are consistent in using the system can observe better physical health due to their consistency in exercising.

  o Increase In Gym Members – Since the system offers benefits in the form of rewards, a potential increase in gym memberships can be expected.

  o Gym Members Are More Engaged in Exercising – The system incorporates gamification which can lead to more user engagement when exercising.

  o Increase In Revenue For Gyms - An increase in customers means revenue will also be increased for gym establishments.

- Intangible Benefits

  o Increased Motivation Levels For Gym Members - Members who are engaged in the system can feel an increase in their motivation level caused by the reward system integrated in FitQuest.

  o Increased Consistency In Exercising For Gym Members - The reward system can cause members to become more consistent when it comes to exercising regularly.

  o More Enjoyment In Exercising - By utilizing the principles of gamification, gym members can feel more enjoyment when exercising.

  o Exercising Feels More Rewarding - Gym members who exercise regularly will be rewarded, which can lead to a more rewarding experience when exercising.

3.2. Project Design

This section serves as the framework for designing and implementing requirements for FitQuest. It also outlines the interface, data, and architectural design of the project
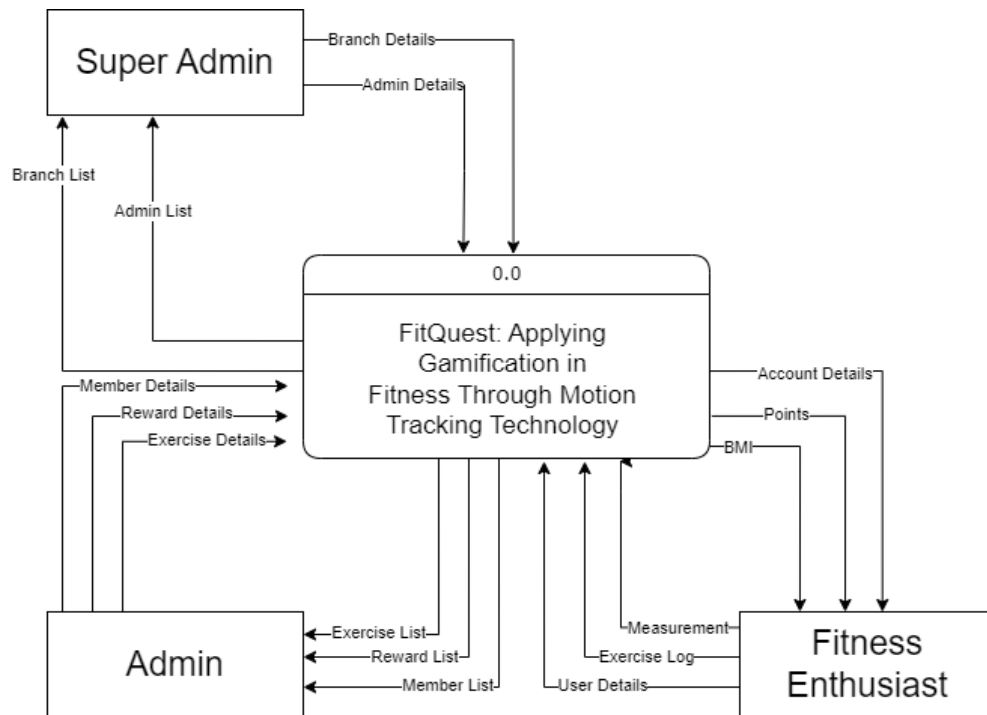
Context Diagram

Figure 9. Context Diagram

The system consists of three actors, the super admin, admin and user. Each actor interacts with the system in different ways.

Data Flow Diagram

This diagram represents the way data is managed in the system.
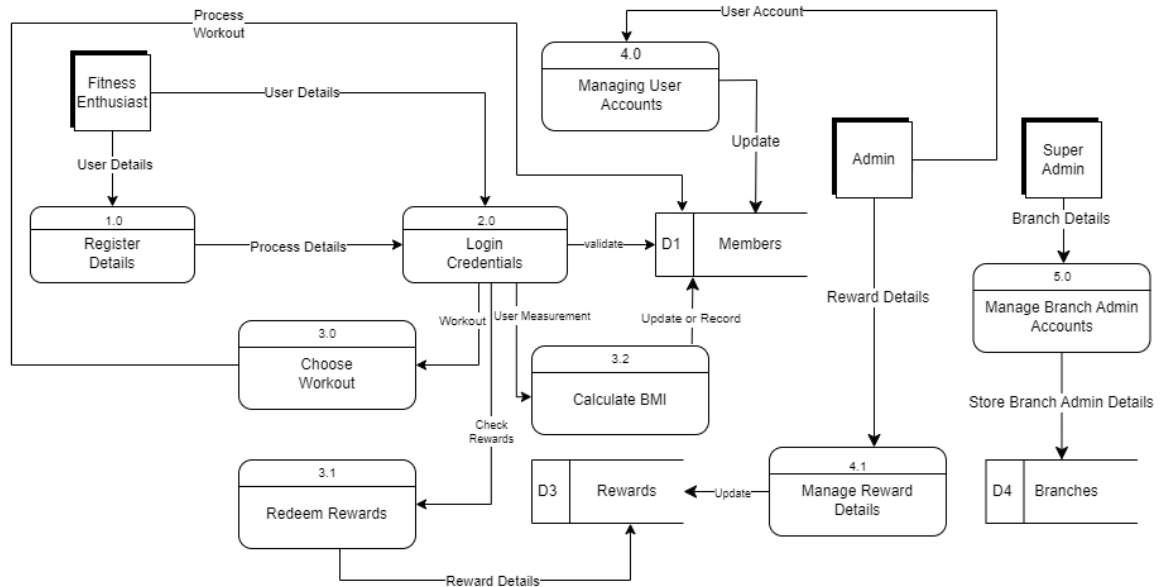

Figure 10. Data Flow Diagram

The diagram depicts how user data, workout information, and reward details are processed and managed. It outlines the key processes involved, including user registration, workout tracking, reward redemption, and administrative functions such as managing user and reward details. The data flow diagram provides a visual representation of the system's logic and how data interacts with different components.
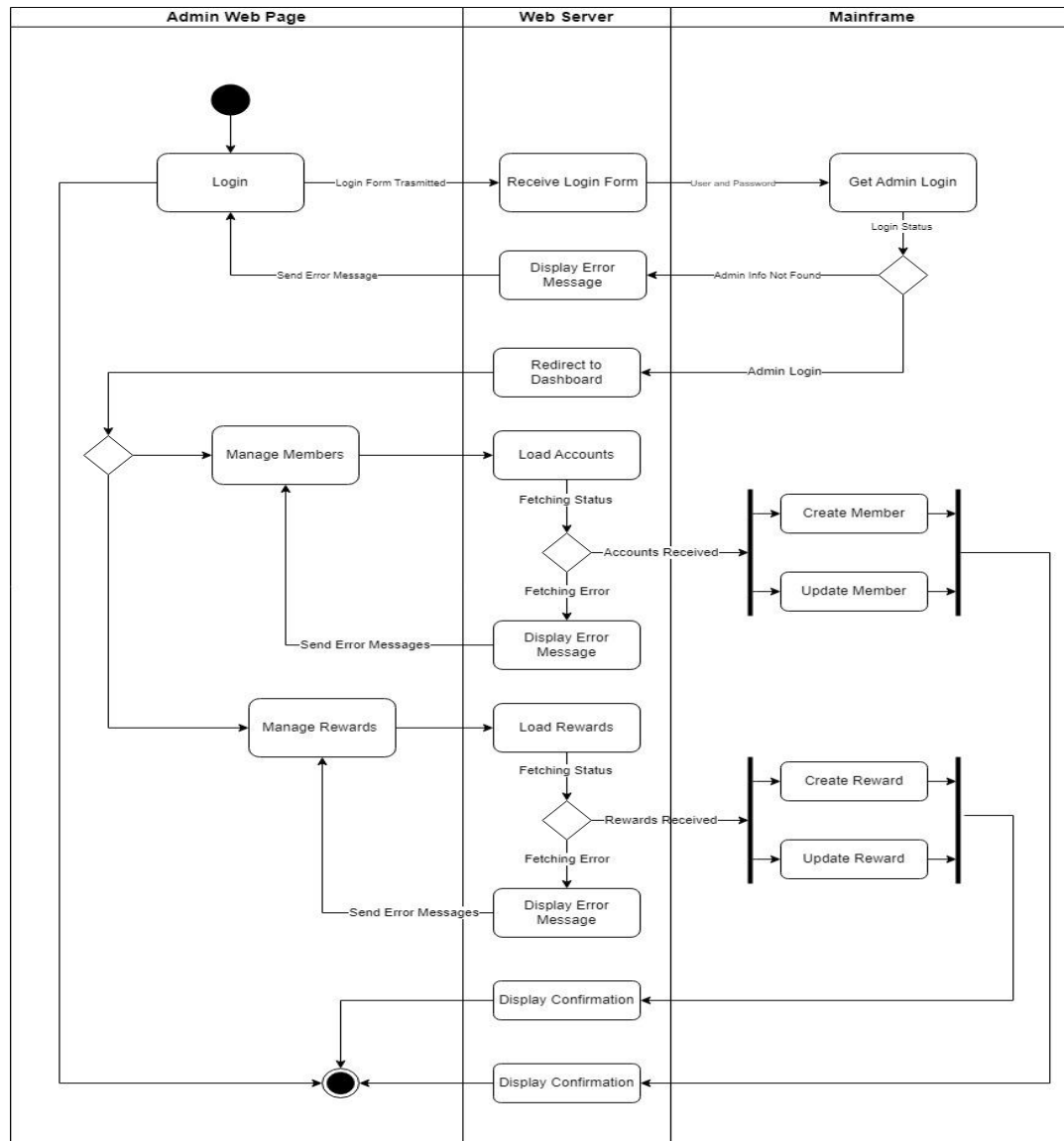
Activity Diagram

Figure 11. Activity Diagram for Administrator

The diagram outlines the processes involved in managing members and rewards. It depicts the flow from initial login, through member and reward management functions, to confirmation and system exit. The activity diagram highlights the interactions between the admin web page, web server, and mainframe, showcasing the steps involved in creating, updating, and managing member and reward data within the system.
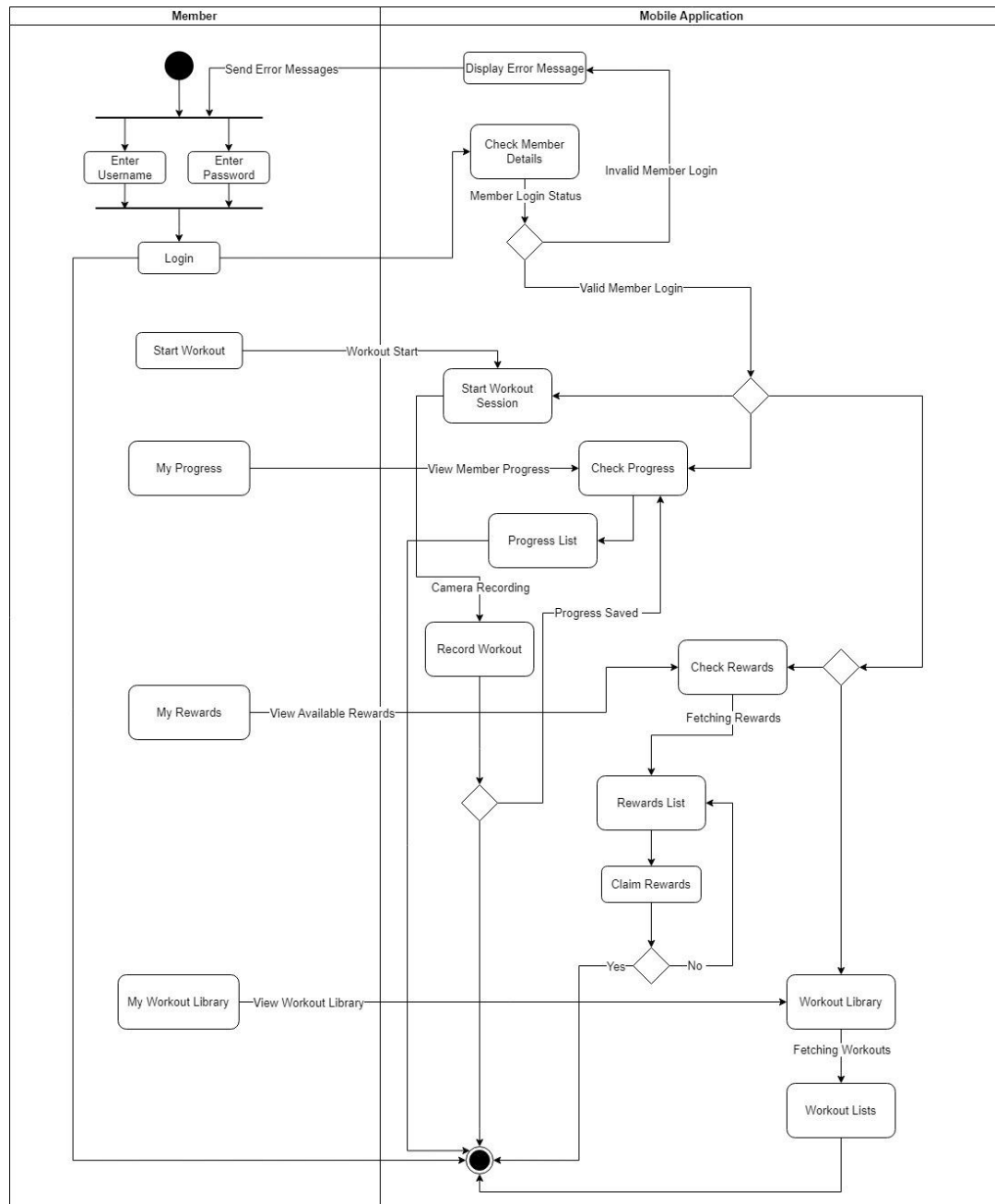
Figure 12. Activity Diagram for Gym Members

The diagram depicts the various actions a member can take within the system, including

login, workout initiation, progress tracking, reward claiming, and accessing workout

libraries. It outlines the decision points and conditions that influence the flow of activities,

such as checking member login status, verifying progress, and determining reward availability. The diagram also includes error handling mechanisms for situations like invalid login credentials or system issues. Overall, this activity diagram provides a visual representation of the user experience and the dynamic interactions within the FitQuest system for gym members.
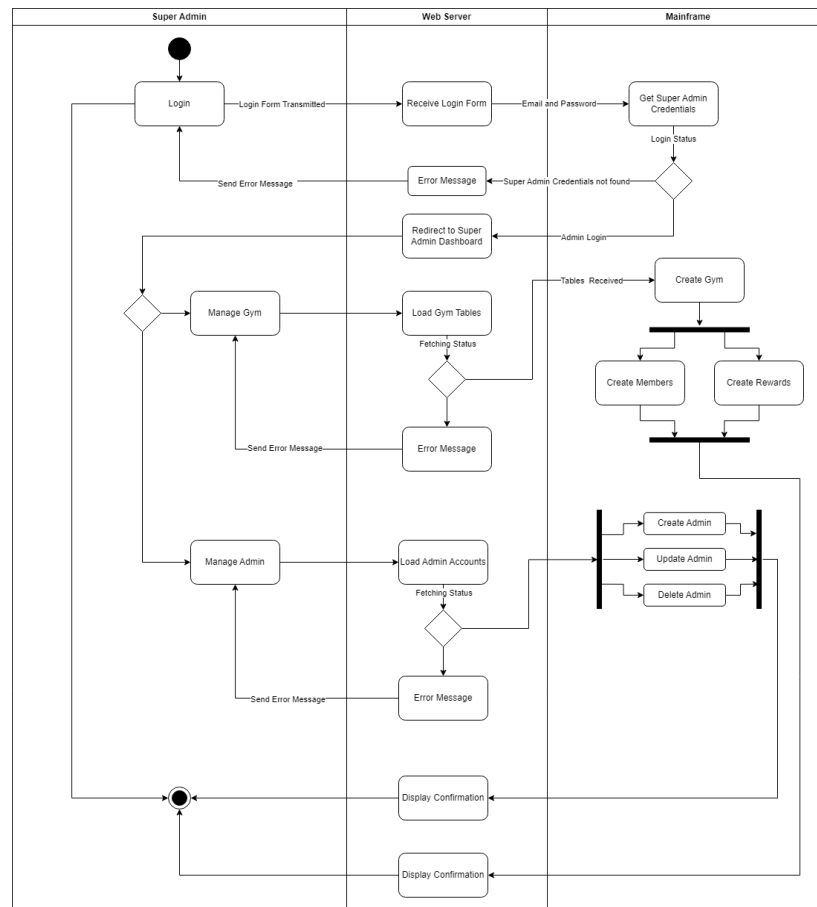

Figure 13. Activity Diagram for Super Admin

The diagram illustrates the interactions between a Super Admin, a Web Server, and a Mainframe in the context of managing a gym system. The Super Admin can log in and, upon successful authentication, access functionalities like creating a new gym and

managing existing gym administrators. The "Manage Gym" process involves loading gym tables and potentially handling errors. Similarly, the "Manage Admin" process enables creating, updating, and deleting admin accounts, also with error handling. The diagram highlights the data flow between the different components, including login credentials, gym tables, admin accounts, and confirmation messages.
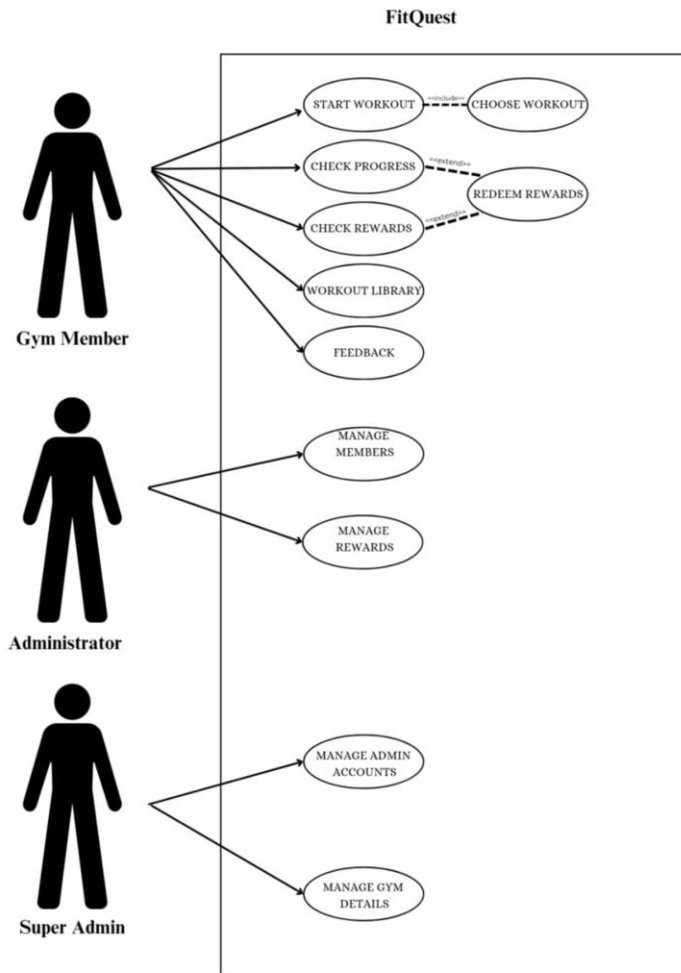
Use Case Diagram

FitQuest

Figure 14. Use Case Diagram

Figure 12 illustrates the interactions of the primary and secondary actors within the system's operations. The primary actor, also known as the gym goer, can choose whether to start a workout, check their progress and available rewards, browse the workout library, or leave feedback. If the gym goer chooses to check their progress. Checking the user's progress will enable them to view the number of points that they have collected and view

their workout history. From the secondary actor or the admin's perspective, they will be

able to manage the members and rewards that are available in the establishment.

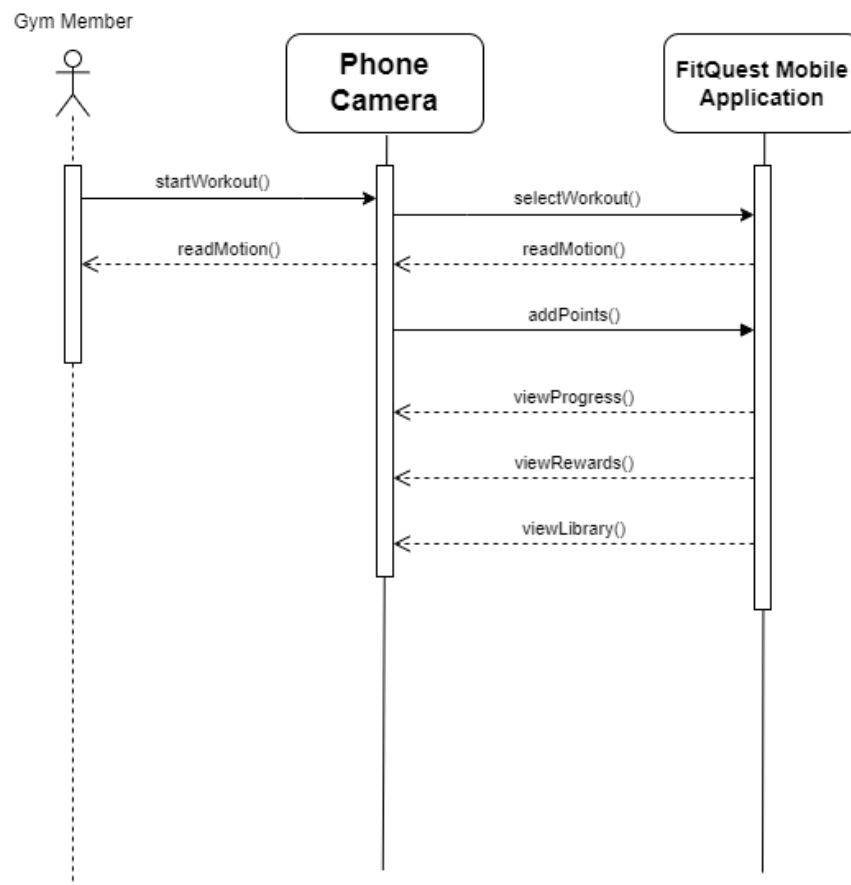**Sequence Diagrams**

Figure 15. Sequence Diagram (Gym Member Side)

The sequence diagram outlines a typical interaction between the gym member, the phone

camera, and the FitQuest mobile application during a workout session. The gym member

starts a workout, the phone camera captures the motion, and the FitQuest application

processes this data to select a workout, add points, and provide progress, rewards, and

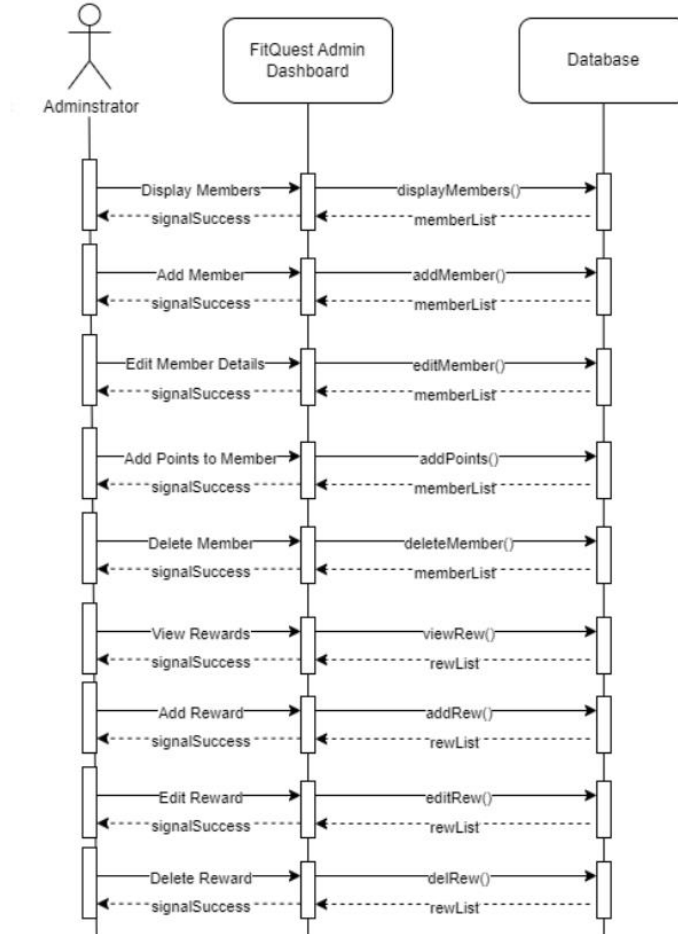library information to the gym member.

Figure 16. Sequence Diagram (Administrator Side)

The system's sequence diagram states the processes and its sequences in the event of the project's implementation. The sequence diagram has been separated into two parts, each part represents the actors that will use the system such as the gym member, and administrator.
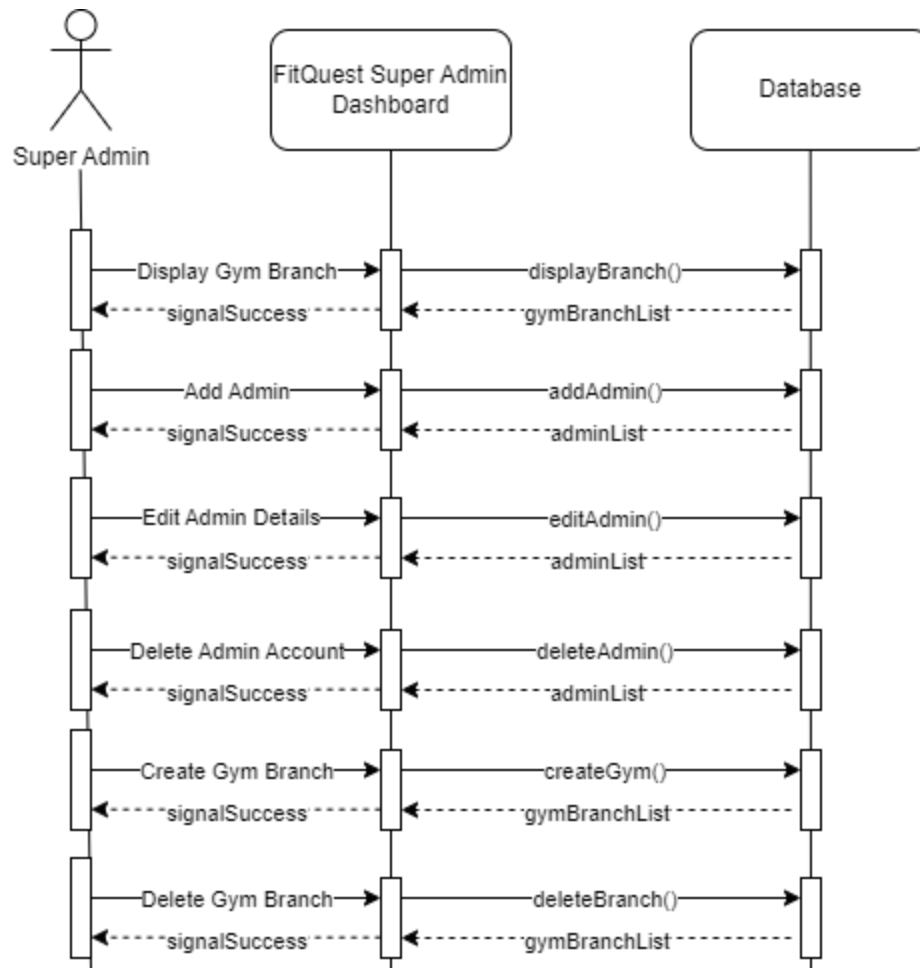
Figure 17. Sequence Diagram (Super Administrator Side)

The system's sequence diagram states the processes and its sequences in the event of the project's implementation. The sequence diagram has been separated into two parts, each part represents the actors that will use the system such as the gym member, and super administrator.
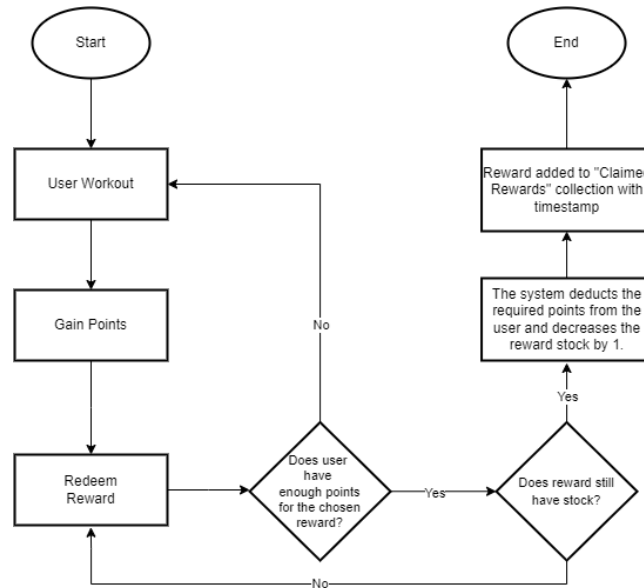
Flowchart for Reward System

Figure 18: Flowchart for Reward System

The flowchart illustrates the reward redemption process within a system. The process commences with the user engaging in a workout session, leading to the accumulation of points. Subsequently, the user initiates a reward redemption attempt. The system then verifies whether the user possesses enough points to acquire the chosen reward. If the user's point balance is insufficient, they are prompted to select a different reward or continue earning points. Assuming the user has the necessary points, the system further checks the availability of the desired reward. In case the reward is out of stock, the user is again directed to the reward selection stage. Upon successful validation of both point balance and reward availability, the system deducts the required points from the user's account and reduces the reward's stock by one. Finally, the system meticulously records this transaction in the "Claimed Rewards" collection, appending a timestamp to mark the exact moment of redemption.

Table 4: Reward Matrix

Points	Reward Name	Required Points	Points After Claiming
1000	Wrist Wraps	50	950
950	Shaker	100	850
850	Protein Powder	500	350

The table above shows the value for each reward and the points required for the user to claim that specific reward. It serves as a visual representation of the conditions under which users can redeem their accumulated points for various rewards. Each reward is associated with a specific points threshold that users must meet or exceed to be eligible for claiming it. The rewards may vary depending on the gym requirements and policy.

ERD

The entity relationship diagram, or ERD, represents classes and its relationship that exists
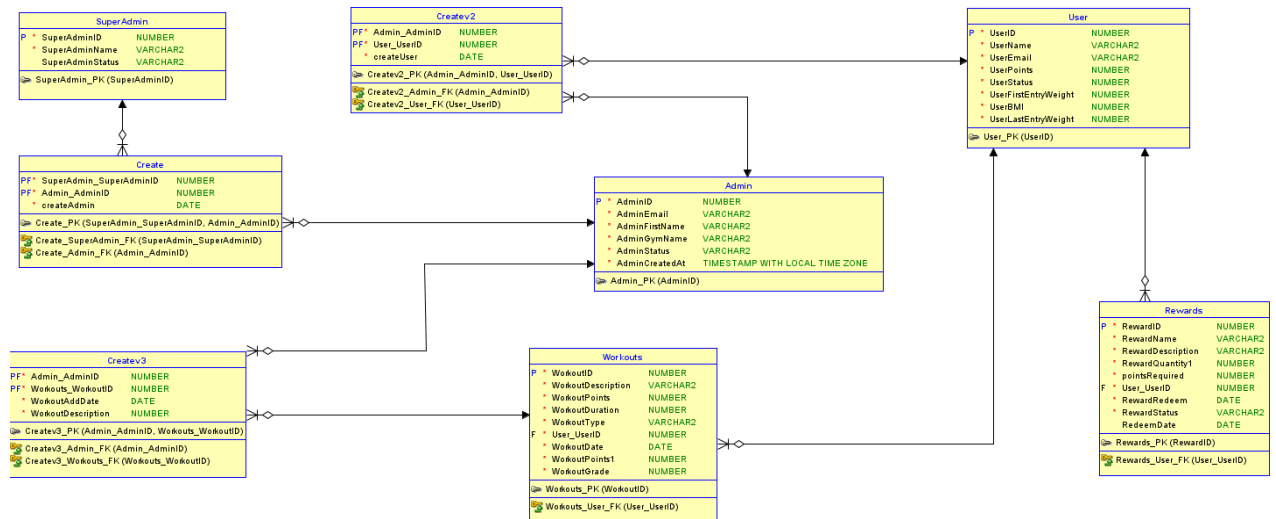
in the system.

Figure 15. Entity-Relationship Diagram

This ERD models the relationships between Admins, Members, Workouts, and Rewards

within the FitQuest application. Admins manage rewards and workouts, while members

can participate in workouts and claim rewards. The diagram shows how these entities are

interlinked through various relationships, ensuring that the database structure supports the

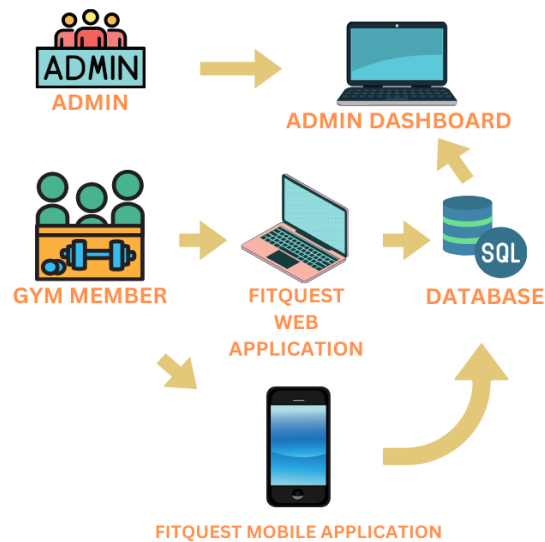necessary interactions for the application's functionality.

System Architecture

Figure 19. FitQuest System Architecture

The figure shows the overall flow of FitQuest's operations. The procedure starts with the gym member starting their workout by choosing from the FitQuest mobile application. Based on their performance, points will be received by the user. Then, the database will be used to communicate between the user's FitQuest account accessible via the admin's dashboard, which is accessible via the web application.

User Interface Design

Mobile Application:
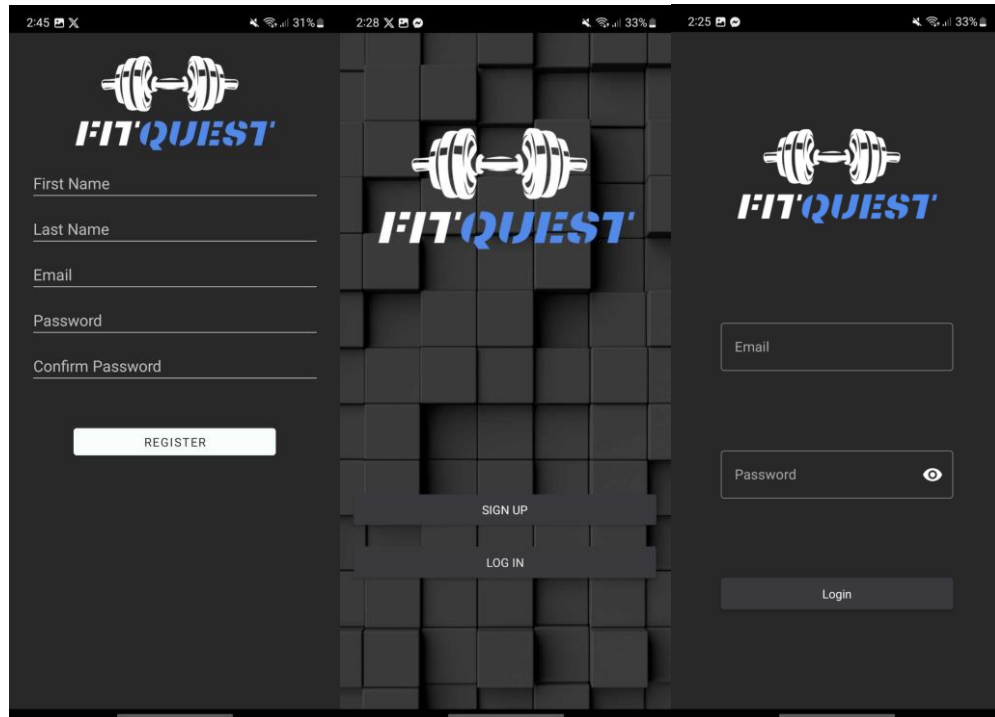
The design showcases two primary screens: a registration screen for new users to input their personal information and create an account, and a login screen for existing users to access their accounts using their email and password. The app features a dark background with a cube pattern, creating a visually appealing and modern aesthetic. The FitQuest logo is prominently displayed on both screens, providing brand recognition.
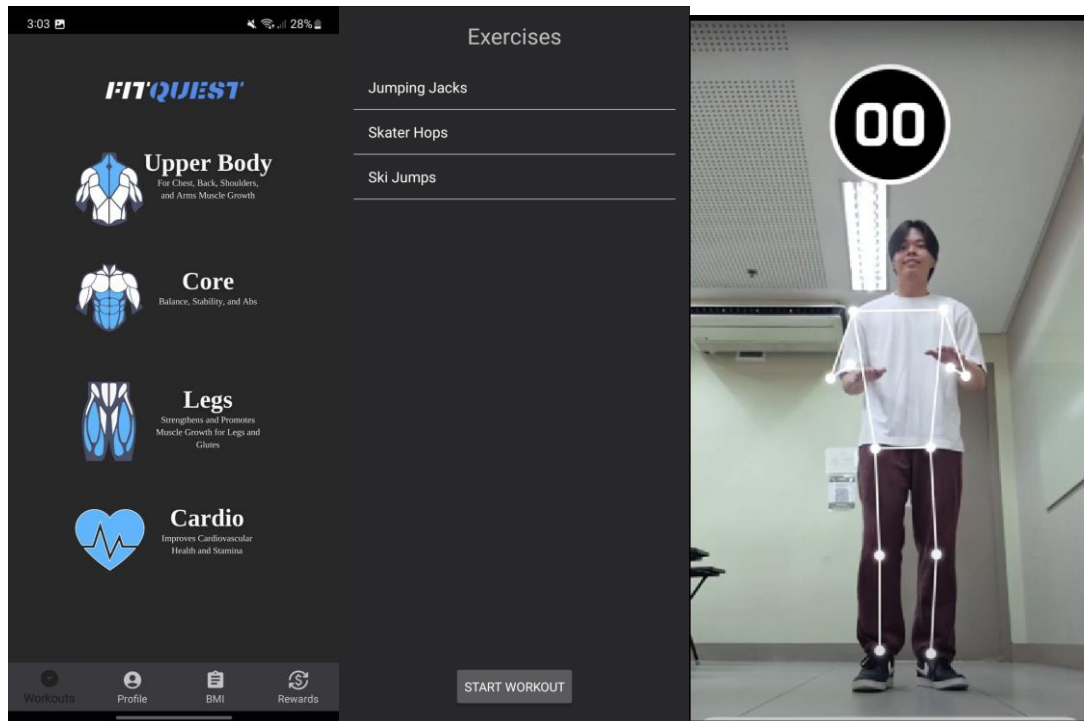
In the first image, there are four types of body workouts: upper body, core, legs, and cardio. The second image shows the interface you'll see after selecting a workout. In the third image, you can see where you'll begin your chosen workout along with the motion tracker algorithm line.
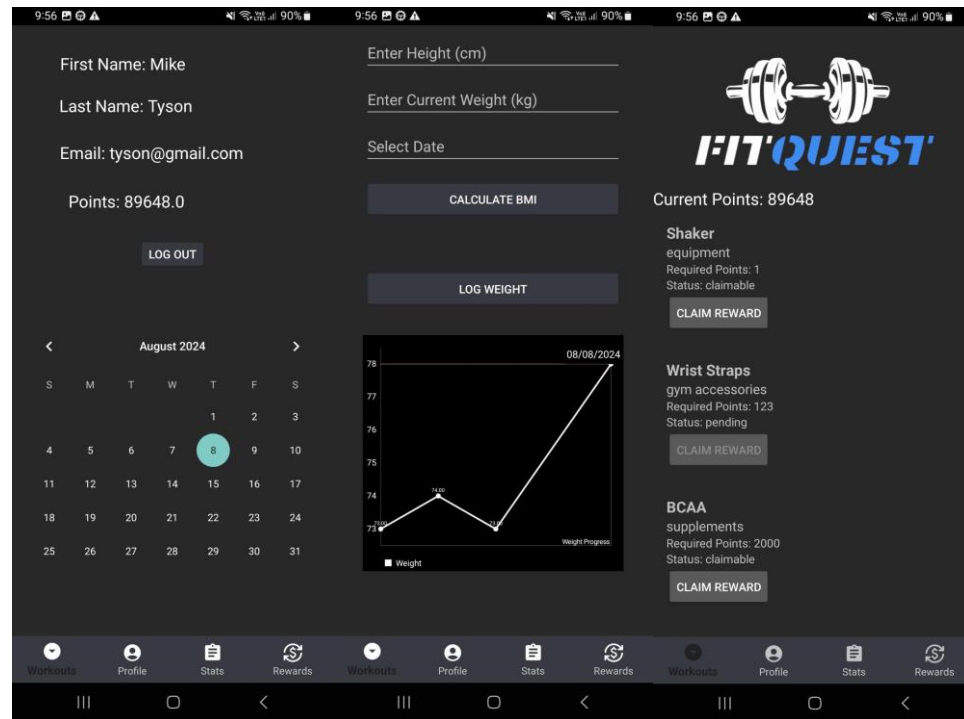
The design showcases a user profile section at the top left corner, displaying the user's name, email, current points and a calendar that tracks the user's workout progress. The central portion of the interface features three primary sections: one for user input, requiring height and weight for BMI calculation, and line graph that monitors the user's weight. The user can also see the rewards that can be claimed, required points and reward status.

Website:
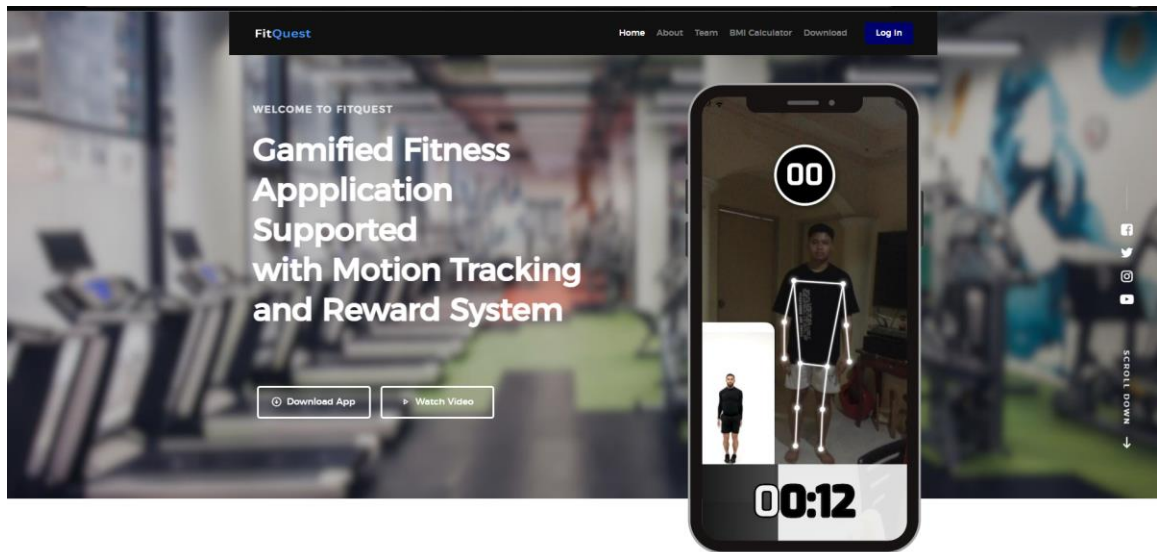
The design features a prominent header with the FitQuest logo and a tagline emphasizing

gamified fitness supported by motion tracking and a reward system.
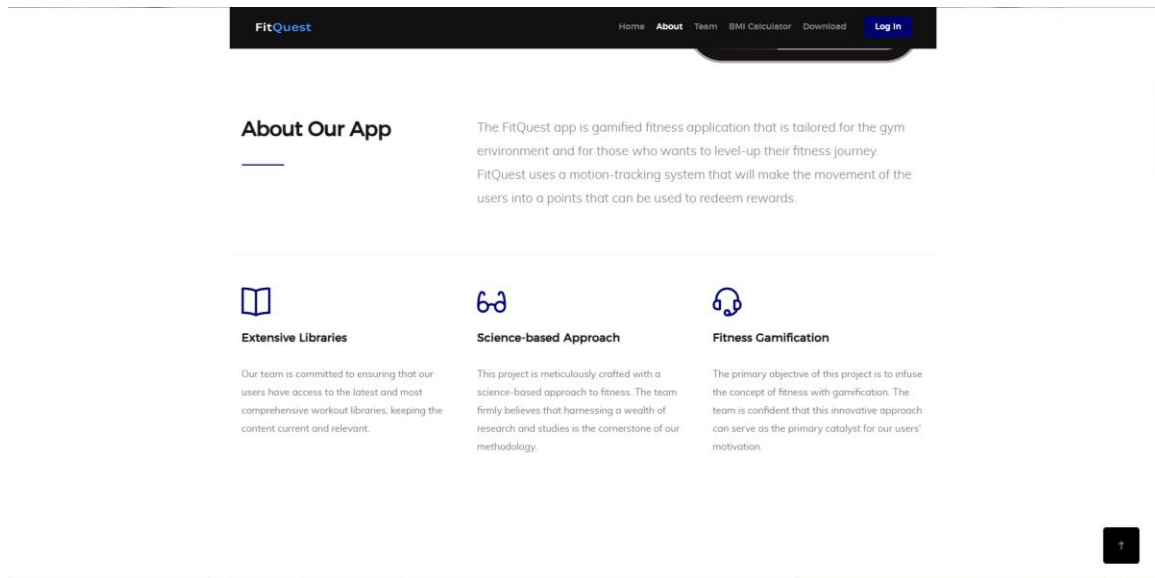
The page prominently displays the FitQuest logo and a concise description highlighting the app's focus on gamified fitness within a gym environment. It emphasizes the use of motion tracking technology to convert user movements into points redeemable for rewards. Below the main description, three icons represent key aspects of the app: extensive workout libraries, a science-based approach, and fitness gamification. This homepage design effectively communicates the app's value proposition and encourages visitors to explore further.

The BMI Calculator page on the FitQuest website offers a user-friendly tool for calculating and understanding Body Mass Index (BMI). Users are required to input their height in centimeters and weight in kilograms. Upon clicking the "Calculate" button, the BMI value is generated along with a corresponding weight status classification based on the standard BMI chart. This feature provides valuable health information to users and aligns with the website's focus on promoting overall fitness and well-being.

FitQuest   Home   About   Team   BMI Calculator   Download

Welcome Back,

tyson@gmail.com

Current Points: 70436

Status: Active User

Weight Entries:

First Entry: 71 kg on 8/2/2024

Last Entry: 74 kg on 8/11/2024

Logout

Pending Rewards:

RWD001 (Status: pending)

Announcements
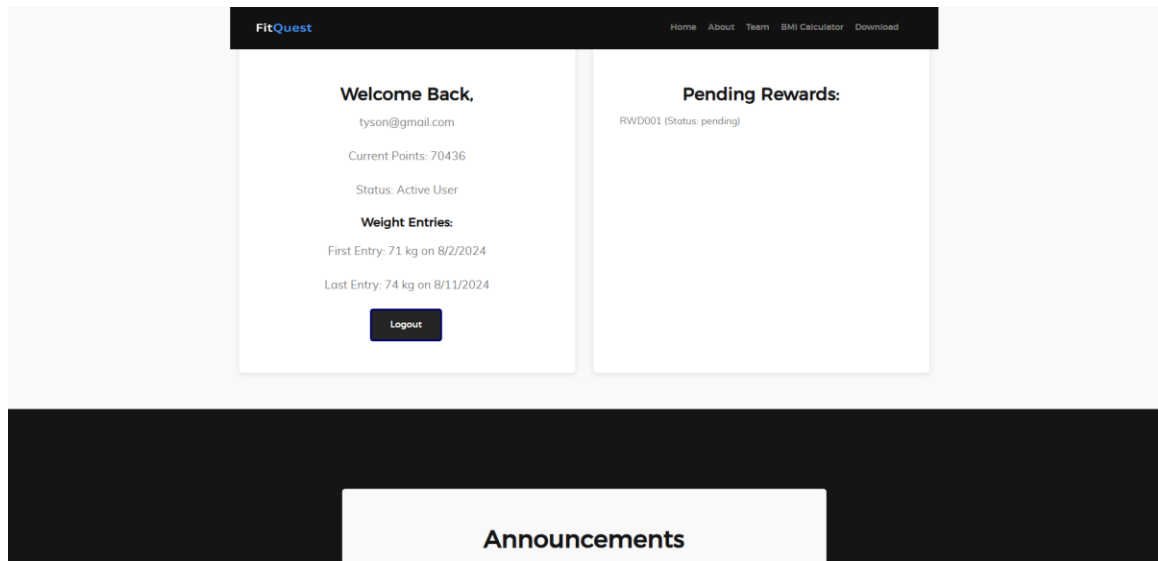
The User Profile page contains the user's email, current points and status. It also shows there the weight entries made by the user to compare and track their progress from their first and last entry. If the user has pending rewards, it can also be seen in their dashboard.

Admin Dashboard:

| FitQuest | Administrator | | | | | | Home | Manage Points | Inactive Users | Verify Rewards | | Logout |

| 9 Users | | 4 Rewards | | 0 Deactivated Accounts | | | Add Reward | | | Add New User | |

ID	First Name	Last Name	Email	Account Status	Actions		Reward ID	Reward Name	Description	Required Points	Status	Actions
U001	new	man	newman@gmail.com	Active User	☑ ⏻		RWD001	Shaker	equipment	1	Claimable	☑ 🗑
U002	Macho Man	Randy Savage	machomanreal@gmail.com	Active User	☑ ⏻		RWD002	Wrist Straps	gym accessories	123	Claimable	☑ 🗑
U003	Male	Manipulator	manipulator@gmail.com	Active User	☑ ⏻		RWD003	BCAA	supplements	2000	Claimable	☑ 🗑
U004	Sam	Sulek	samsulek@gmail.com	Active User	☑ ⏻		RWD004	white compression shirt	gym garments	1200	Claimable	☑ 🗑
U005	Tren	Twins	trentwinsreal@gmail.com	Active User	☑ ⏻							
U006	Qwertt	qwerty	qwerty@gmail.com	Active User	☑ ⏻							
U007	Mike	Tyson	tyson@gmail.com	Active User	☑ ⏻							
U008	newer	man	newerman@gmail.com	Active User	☑ ⏻							
U009	undefined	undefined	testinggg@gmail.com	Active User	☑ ⏻							

The Admin Dashboard provides a centralized overview of the FitQuest system's key metrics and management functionalities. The dashboard prominently displays the total number of registered users and available rewards, offering a quick snapshot of the system's current state. It also includes sections for managing user points, user accounts, and reward details. Administrators can view a list of registered users with their respective information and perform actions such as updating or deleting user accounts. Similarly, the rewards section allows administrators to manage available rewards by adding, updating, or deleting them. The dashboard's design is clean and intuitive, providing easy access to essential administrative tasks.
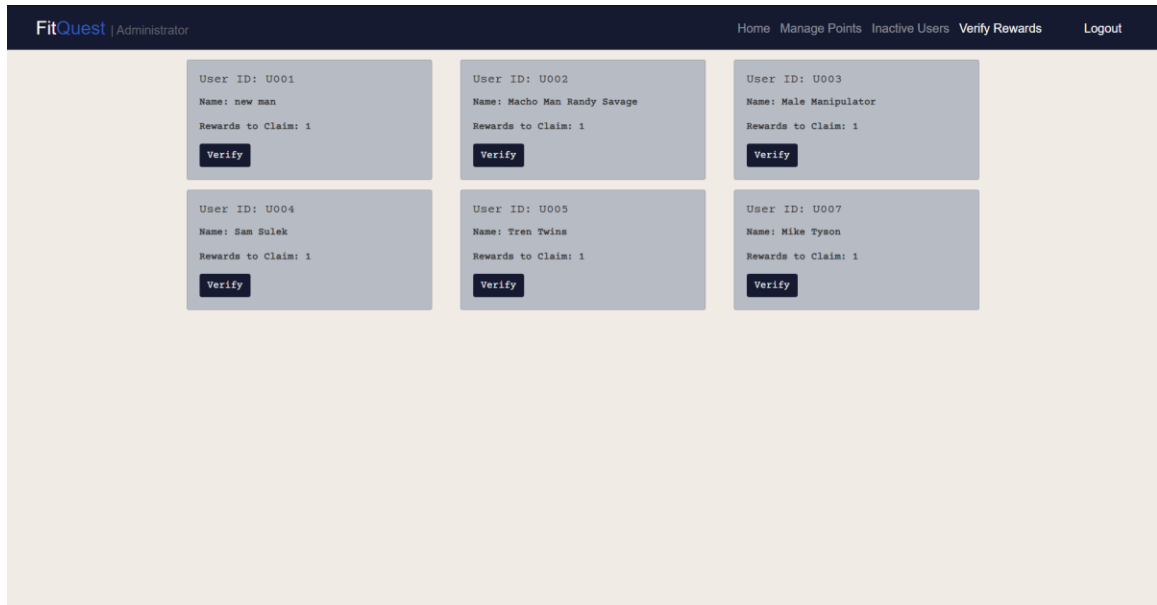
This section allows administrators to oversee and manage registered users within the system. It displays a list of users with their respective user IDs, email addresses, first names, last names, and accumulated points. Administrators have the ability to update or remove points for each user by clicking the corresponding "Update Points" button. Additionally, the "Add/Remove" buttons provide functionality for adding or removing users from the system. The user interface maintains a consistent dark theme with clear labels and button elements, enhancing usability and visual appeal.

3.3 Project Development

This section outlines the tasks and organization of the researcher group which also serves as guide for the researchers in their regular task management meetings.

Scrum Agile Diagram
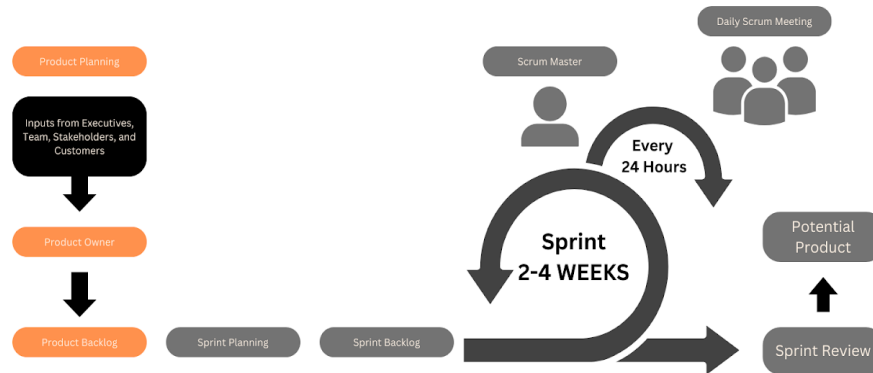
Figure 17: Scrum Agile Diagram

The Scrum Agile process begins with Product Planning, where inputs are gathered from various sources such as executives, team members, stakeholders, and customers.

These inputs are then managed and prioritized by the Product Owner to create the Product Backlog, which is a list of tasks and requirements for product development.

The next stage is Sprint Planning, where items from the Product Backlog are selected to form the Sprint Backlog. A Sprint then takes place over a period of 2-4 weeks, during

which the Scrum Team works to complete the selected items. The Scrum Master plays a crucial role in facilitating the process, including the Daily Scrum Meetings that are held every 24 hours to track progress and plan the work for the next 24 hours.

At the end of the Sprint, the work completed results in a Potential Product. A Sprint Review is then held to present this Potential Product, providing an opportunity for the Scrum Team to showcase their work and for stakeholders to provide feedback. The process then repeats for the next Sprint, making Scrum a continuous cycle of improvement.

Product Backlog

The system's product backlog includes a prioritized list of features, enhancements, bug fixes, and other tasks that the researchers plan to work on in the future.

Figure 20. FitQuest Backlog

This backlog outlines the development roadmap for FitQuest and includes items such as a leaderboard module to foster competition, a meal planning module for dietary guidance, enhancements to the user interface, accessibility options for inclusivity, and performance optimizations for a smoother user experience.

Sprint Goal

To develop and implement the core functionalities of the FitQuest application, including motion tracking integration, exercise library, customizable reward system, progress monitoring module, and feedback mechanism, ensuring the seamless operation and effectiveness of gamification techniques in enhancing user motivation and consistency in exercising. Additionally, to conduct preliminary testing using ISO 9126 standards to evaluate the system's quality and readiness for further refinement and enhancement.

3.4 Data Gathering

This section contains the data gathered from the interviews and surveys conducted. The data gathering procedures were done with the intention of finding out the most common issues, observations, and recommendations of individuals that are involved in fitness.

Sampling Techniques

The researchers used a purposive random sampling technique to gather quantitative data to target a more accurate group of respondents. In the case of the system, gym members who are working out will be randomly picked to answer a questionnaire. This method ensures that the data gathered will be relevant to the study. The random sampling technique is also very efficient when it comes to gathering data, since the task of finding respondents will be trivial. The technique also ensures that the data gathered will be valuable in designing user experience.

Statistical Treatment

The mean, or average, will be mainly used to treat the quantitative data that was gathered. This statistic is straightforward and effective data that can be translated into valuable information. Utilizing the mean can provide a very accurate representation of the dataset. Which enables the researchers to develop and design the features with a reliable guide. The mean can also be the basis for further statistical analysis which makes it a crucial starting point for understanding the distribution of the data gathered. The formula for finding the mean is $m = \frac{sum\ of\ the\ terms}{number\ of\ terms}$.

3.5 Testing

In this section, the quality, reliability, and performance of FitQuest will be tested and emphasized. Different types of testing such as Alpha, Beta, User Acceptance, and Security testing will be utilized to ensure FitQuest will have a solid foundation when developed.

Alpha Testing

Alpha testing will be conducted to test various aspects of FitQuest. Like most softwares, alpha testing will be done internally, which means the researchers will be the sole testers of the system. Identification of possible issues and bugs will be crucial in this phase; therefore, it is also the main goal during the procedures of alpha testing. As the sole testers of FitQuest in alpha testing, the researcher's will conduct tests that involve that functionality of the system, emphasizing the various

features of 69 the system, its usability which includes the intuitiveness of the interface and the performance of the system.

Beta Testing

Following the alpha testing phase of FitQuest, beta testing will be conducted to uncover issues that were not found. Beta testing will be focusing on external user feedback to gain insights on how to further improve the system. During this phase, real users of the system will engage to validate and ensure that it works as intended. This testing phase will also ensure that the system is compatible with Android and different web browsers. System vulnerabilities will also be located and pinpointed for security reasons. The system will also undergo various loads to discover its ability to handle heavier loads. The beta testing phase also allows for the researchers to gather user feedback and recommendations that can be utilized to further improve the system.

ISO 9126

This international standard will be used to evaluate the quality of the system. The researchers decided that ISO 9126 is relevant and useful for testing and understanding the quality of the system. The following are characteristics that will be tested with the standard in mind:

- Functionality - The researchers will ensure the system can perform the appropriate modules and requirements that are aligned with the objectives. The system's accuracy and security will also be tested.

- Reliability - The system should be stable under normal operating conditions and has high fault tolerance to ensure that the system can run in long periods of time. In the cases of crashes and other failures, the system should be able to recover well.

- Usability - The system should be easy to use for all users and it can easily be understood. The user interface and user experience will be focused in this part of the test.

- Efficiency - The system should be able to respond timely and can process modules without difficulty. The system should also be able to utilize resources efficiently.

- Maintainability - The system should be maintainable and scalable so that it can function for a long time and can be updated in the future.

- Portability - The system should be adaptable so that it can work in different gym environments and set-up.

Chapter 4

RESULTS AND DISCUSSION

This chapter provides an analysis and an interpretation of the data that was gathered from the survey. It discusses the results of the test cases as well as the system evaluation of Fitness Enthusiast, Fitness Coach and IT Experts. This evaluation is intended to evaluate the proposed system based on the ISO 9126 Software Quality Model for IT Professionals and Technology Acceptance Model for the Non-IT Professionals.

4.1 Presentation of Results

The study collected quantitative forms of data, which were utilized in the statistical evaluation and presentation of the results. The researchers constructed two types of system evaluation survey questionnaires: For Fitness Enthusiasts or Users which has 26-item questions, Fitness Coach which has 26-item questions, and for IT Experts which has 27-item questions. All survey questionnaires were used as the basis for evaluating the quality of the proposed system using the ISO 9126 Software Quality Model, specifically the functionality, reliability, usability, efficiency, maintainability, and portability of the system. There are a total of 35 individuals who have responded to the System Evaluation Survey. The 35 individuals are; 25 Fitness Enthusiasts, 5 Fitness Coach, 5 IT Experts.

4.2 Test Case

The following are the results of the test cases that were conducted to guarantee that all modules function according to their intended output and that any errors are recognized and resolved prior to the deployment of the system.

Table 4. Summary of Web Test Cases - Administrator

Administrator	Testing 1	Testing 2	Testing 3
Members Management Module	PASS	PASS	PASS
Rewards Management Module	FAIL	PASS	PASS
Points Management Module	FAIL	PASS	PASS

The Members Management Module successfully passed all tests, indicating proper functionality. Conversely, both the Rewards and Points Management Modules encountered issues during the initial test but successfully passed subsequent tests. This suggests potential problems within these modules that were resolved through corrective actions. Further investigation into the root causes of the initial failures is recommended to prevent recurrence and ensure the overall reliability of the Administrator module.

Table 5. Summary of Web Test Cases – Fitness Enthusiast

Fitness Enthusiast	Testing 1	Testing 2	Testing 3
Register & Login Module	PASS	PASS	PASS
Redeem Reward Module	FAIL	PASS	PASS
Profile Module	PASS	PASS	PASS

The Register & Login Module successfully passed all tests, indicating proper functionality. The Redeem Reward Module encountered issues during the initial test but successfully passed subsequent tests, suggesting potential problems that were resolved through corrective actions. The Profile Module successfully passed all tests, indicating proper functionality. Further investigation into the root causes of the initial failures in the Redeem Reward Module is recommended to prevent recurrence and ensure the overall reliability of the Fitness Enthusiast module.

Table 6: Summary of Mobile Application Test Case – Fitness Enthusiast

Fitness Enthusiast	Testing 1	Testing 2	Testing 3
Register & Login Module	PASS	PASS	PASS
Motion Tracking	FAIL	PASS	PASS
Reward Module	FAIL	PASS	PASS
BMI Calculator	PASS	PASS	PASS
Exercise Module	FAIL	PASS	PASS

The Register & Login Module and BMI Calculator successfully passed all tests, indicating proper functionality. The Motion Tracking, Reward Module, and Exercise Module encountered issues during the initial test but successfully passed subsequent tests, suggesting potential problems that were resolved through corrective actions. Further investigation into the root causes of the initial failures in the Motion Tracking, Reward Module, and Exercise Module is recommended to prevent recurrence and ensure the overall reliability of the Fitness Enthusiast module.

Table 7: Summary of Frequency Distribution of Respondents

Respondents	Frequency	Percentage
Gym Members	25	78.125%
Fitness Coaches	5	15.625%
IT Experts	5	14.29%
Total	**35**	**100%**

The total of 35 individuals participated, with Gym Members comprising the largest group at 78.13%, followed by Fitness Coaches at 15.63%, and IT Experts at 14.29%. This distribution suggests that the majority of participants were directly involved in gym-related activities.

Table 8: Rating Reference

Weight / Scale	Mean	Verbal Interpretation
5	4.51 - 5.00	Strongly Agree
4	3.51 - 4.50	Agree
3	2.51 - 3.50	Neutral
2	1.51 - 2.50	Disagree
1	1.00 - 1.50	Strongly Disagree

The scale ranges from 1 to 5, with 5 representing "Strongly Agree" and 1 representing "Disagree." Mean scores falling within the specified ranges for each weight/scale correspond to the respective verbal interpretation. For example, a mean score of 4.2 would be interpreted as "Agree." This table allows for a clear understanding of the level of agreement or disagreement expressed by the respondents based on their mean scores.

A. Fitness Coach Evaluation Result

The result of the data that was collected and evaluated to interpret the overall experience of members is presented in the tables and figures that follow. There are a total of 35 respondents, which include Fitness Enthusiasts, Fitness Coach and IT Experts.

Table 9: Fitness Coach Evaluation Result

Fitness Coach Evaluation Result		
Component	**Weighted Mean**	**Responses**
A. Functionality	4.08	Agree
B. Reliability	4.25	Agree
C. Usability	4.33	Agree
D. Efficiency	4.26	Agree
E. Maintainability	4.35	Agree
F. Portability	4.40	Agree
TOTAL	**4.27**	**Agree**

The estimated weighted mean for each component of the ISO 9126 Software Quality Model is presented in the table above. All six (6) components received responses of "Agree." The overall determined total weighted mean was 4.27, which corresponds to the response "Agree." This indicates that, on average, the fitness coaches agree with the system's overall component.

Table 10: Fitness' Coach Evaluation Mean Summary

Statement	SA (5)	A (4)	N (3)	D (2)	SD (1)	Frequency	Mean	Response
1. The application provides all the necessary features to monitor and guide my clients' fitness activities.			4	1		5	2.8	Neutral
2. The motion tracking feature accurately records my clients' movements.		4	1			5	3.8	Agree
3. The application integrates well with other fitness tools and devices I use.	1	3	1			5	4	Agree
4. I can easily customize fitness plans and workouts for different clients.	1	3	1			5	4	Agree
5. The application allows me to effectively track and monitor my clients' progress.	2	3				5	4.4	Agree
6. The application runs smoothly without	4	1				5	4.8	Strongly Agree

interruptions during training sessions.								
7. The application continues to function correctly even when minor issues occur.	2	3				5	4.4	Agree
8. The application recovers quickly and accurately from any crashes or failures.	3	1	1			5	4.4	Agree
9. The application's performance remains consistent across different sessions.	2	3				5	4.4	Agree
10. The application's interface and features are easy to understand and use.	2	3				5	4.4	Agree
11. It was easy to learn how to use all the features of this application.	4	1				5	4.8	Strongly Agree
12. The application is intuitive and easy to use during coaching sessions.	3	2				5	4.6	Strongly Agree
13. The design and layout of the application are visually appealing and professional.	3	2				5	4.6	Stroly Agree

Statement								
14. The application provides helpful feedback and support for both coaches and clients.	3	1	1			5	4.4	Agree
15. The application engages clients and keeps them motivated to reach their fitness goals.	3	2				5	4.6	Strongly Agree
16. The application responds quickly to inputs and commands during workouts.	2	3				5	4.4	Agree
17. The application efficiently uses my devices resources without causing slowdowns.	3	2				5	4.6	Strongly Agree
18. The application performs well under heavy use, such as during back-to-back sessions.	2	3				5	4.4	Agree
19. It is easy to understand and diagnose any issues or errors that arise.	2	2	1			5	4.2	Agree
20. Updates and changes to the application are implemented smoothly without disrupting my work.	4	1				5	4.8	Strongly Agree
21. The application remains stable and reliable after updates and changes.	5					5	5	Strongly Agree

Statement								
22. The application's features can be easily tested to ensure they work as expected.	4	1				5	4.8	Strongly Agree
23. The application works well on different devices (e.g., phone, tablet, computer).	3	2				5	4.6	Strongly Agree
24. Installing the application was easy and straightforward.	3	2				5	4.6	Strongly Agree
25. The application is compatible with different operating systems and platforms.	3	2				5	4.6	Strongly Agree
26. Upgrading to new versions of the application is easy and does not cause issues.	2	2	1			5	4.2	Agree

There are twenty-six (26) questions on the fitness coaches' application evaluation survey questionnaire, as shown in the table above. The mean for each item was determined, and the majority of responses were "Strongly Agree." There was a total of five (5) responses collected for each statement.

Functionality (Fitness Coach Evaluation)

2. The motion tracking feature accurately records my clients' movements.

5 responses
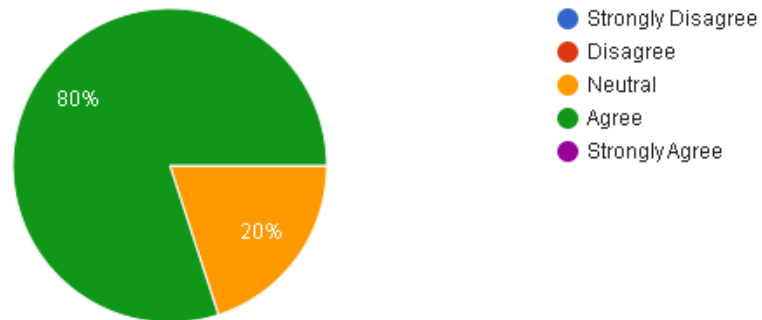
Figure 21: Fitness Coach response to System's Motion Tracking Feature

Functionality = ((0*5)+(4*4)+(1*3)+(0*2)+(0*1))/5 = 3.8

The figure illustrates the responses of 5 fitness coaches to a question about the accuracy of the motion tracking feature in a system they use. The majority (80%) agreed that the motion tracking feature accurately records their clients' movements, while 20% agreed. No coaches strongly disagreed or strongly agreed, and none were neutral.

Usability (Fitness Coach Evaluation)

11. It was easy to learn how to use all the features of this application.

5 responses
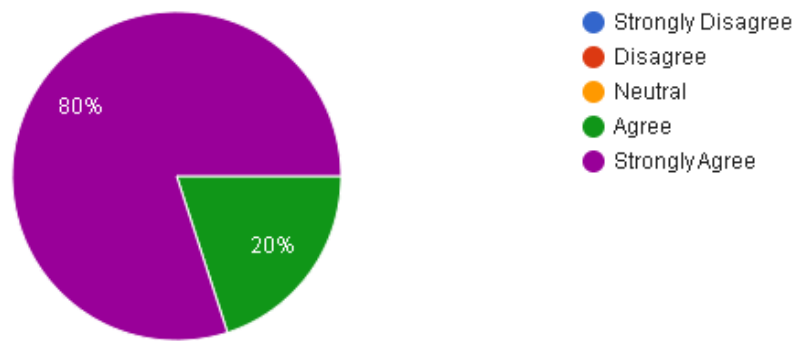
Figure 22: Fitness Coach Response to System's Learnability

Usability= ((4*5)+(1*4)+(0*3)+(0*2)+(0*1))/5 = 4.8

The figure illustrates the responses of 5 fitness coaches to a question about the ease of learning how to use all the features of an application. The results show a stark contrast, with 80% of the coaches strongly agreeing with the statement and 20% agreeing.

Reliability (Fitness Coach Evaluation)

6. The application runs smoothly without interruptions during training sessions.

5 responses
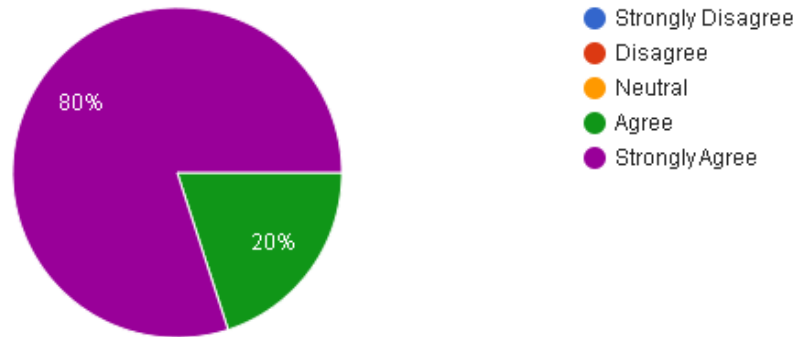
Figure 23: Fitness Coach Response to System's Reliability

$$\text{Usability} = ((4*5)+(1*4)+(0*3)+(0*2)+(0*1))/5 = 4.8$$

The figure illustrates the responses of 5 fitness coaches to a question about the reliability of the system during training sessions. The results show a stark contrast, with 80% of the coaches strongly agreeing with the statement and 20% agreeing.

Portability (Fitness Coach Evaluation)

24. Installing the application was easy and straightforward.

5 responses

Figure legend:
- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree
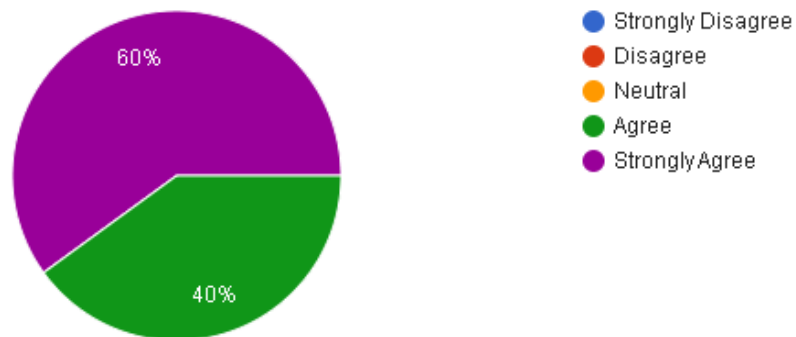
Figure 24: Fitness Coach Response to System's Portability

Usability= ((3*5)+(2*4)+(0*3)+(0*2)+(0*1))/5 = 4.6

The figure illustrates the responses of 5 fitness coaches to a question about the portability of the system, testing if it is easy to use and straightforward. The results show a stark contrast, with 60% of the coaches strongly agreeing with the statement and 40% agreeing.

Maintainability (Fitness Coach Evaluation)

19. It is easy to understand and diagnose any issues or errors that arise.

5 responses

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree
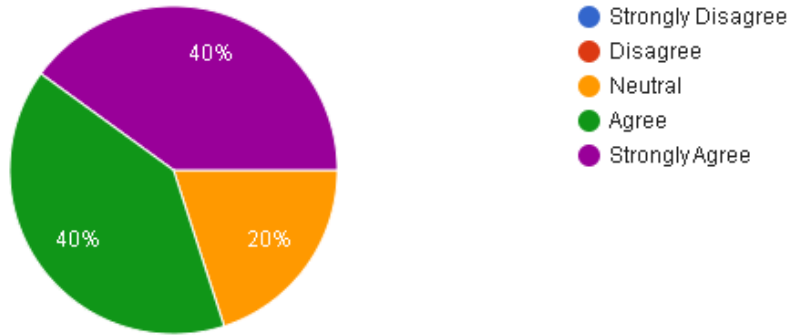
Figure 25: Fitness Coach Response to System's Reliability

Usability= ((2*5)+(2*4)+(1*3)+(0*2)+(0*1))/5 = 4.2

The figure illustrates the responses of 5 users to a question about the maintainability of the system, checking if the errors that will occur will be easy to understand or diagnose. The results show a stark contrast, with 40% of the coaches strongly agreeing, 40% just agreeing with the statement and 20% remaining neutral.

Efficiency (Fitness Coach Evaluation)

18. The application performs well under heavy use, such as during back-to-back sessions.

5 responses
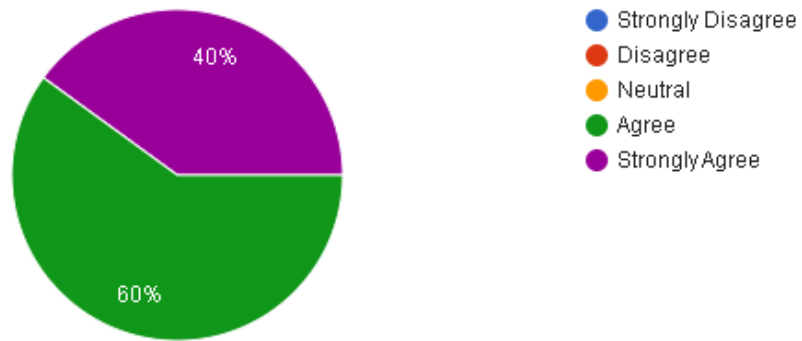
Figure 26: Fitness Coach Response to System's Efficiency

Usability= ((2*5)+(3*4)+(0*3)+(0*2)+(0*1))/5 = 4.4

The figure illustrates the responses of 5 fitness coaches to a question about the efficiency of an application under heavy use, such as during back-to-back sessions. The results show a positive response, with 60% of the coaches agreeing that the application performs well, and 40% strongly agreeing.

Table 11: IT Experts Evaluation Result

IT Experts Evaluation Result		
Component	**Weighted Mean**	**Responses**
A. Functionality	4.40	Agree
B. Reliability	4.35	Agree
C. Usability	4.50	Strongly Agree
D. Efficiency	4.40	Agree
E. Maintainability	4.40	Agree
F. Portability	4.44	Agree
TOTAL	**4.40**	**Agree**

The estimated weighted mean for each component of the ISO 9126 Software Quality Model is presented in the table above. Five (5) out of the six (6) components received responses of "Agree," while one (1) component (Usability) received a response of "Strongly Agree." The overall determined total weighted mean was 4.4, which corresponds to the response "Agree." This indicates that, on average, the IT experts agree with the system's overall component.

Table 12: IT Experts Evaluation Result Mean Summary

Statement	SA (5)	A (4)	N (3)	D (2)	SD (1)	Frequency	Mean	Response
1. The application meets the functional requirements for a fitness app.	3	1			1	5	4.4	Agree
2. The motion tracking algorithms are precise and reliable.	2	3				5	4.4	Agree
3. The application integrates seamlessly with other systems and APIs.	2	2	1			5	4.4	Agree
4. The application\u2019s security features are robust and effective.	3	2				5	4.4	Agree
5. The application complies with relevant industry standards and regulations.	1	4				5	4.4	Agree
6. The application demonstrates stability in various conditions.	1	4				5	4.4	Agree
7. The application can handle and recover from unexpected issues efficiently.	2	3				5	4.4	Agree

Statement								
8. Data recovery processes are efficient and effective after a failure.	3	2				5	4.4	Agree
9. The application is available and operational whenever needed.	4	1				5	4.2	Agree
10. The system architecture and components are easy to understand.	3	2				5	4.4	Agree
11. IT staff and users can learn the system quickly.	3	2				5	4.4	Agree
12. The application is easy to operate and manage from an administrative perspective.	3	2				5	4.6	Strongly Agree
13. The UI design is attractive and professional.	3	2				5	4.5	Strongly Agree
14. The documentation provided is comprehensive and easy to understand.	4	1				5	4.4	Agree
15. The application\u2019s response time is satisfactory.	3	2				5	4.5	Strongly Agree

Statement						Total	Mean	Interpretation
16. The application uses system resources efficiently.	4	1				5	4.4	Agree
17. The application scales well with increased number of users.	4	1				5	4.2	Agree
18. Issues and errors are easy to diagnose.	2	3				5	4.4	Agree
19. Modifications and updates to the application can be made with minimal effort.	3	2				5	4.4	Agree
20. The application remains stable after changes are made.	2	3				5	4.3	Agree
21. The application is easy to test for bugs and performance issues.	1	3	1			5	4.4	Strongly Agree
22. The application\u2019s modules can be modified independently.		5				5	4.4	Agree
23. The application can be easily adapted to different environments.	1	4				5	4.4	Agree

Statement							Mean	Interpretation
24. The installation process is straightforward and user-friendly.	2	3				5	4.6	Strongly Agree
25. The application runs well alongside other software without conflicts.	2	3				5	4.4	Agree
26. The application can be easily replaced or upgraded without significant issues.	2	3				5	4.4	Agree
27. The application can be easily moved and installed on different platforms.	1	3	1			5	4.4	Agree

There are twenty-seven (27) questions on the IT Experts application evaluation survey questionnaire, as shown in the table above. The mean for each item was determined, and the majority of responses were "Agree." There was a total of five (5) responses collected for each statement.

Functionality (IT Experts Evaluation)

2. The motion tracking algorithms are precise and reliable.

5 responses
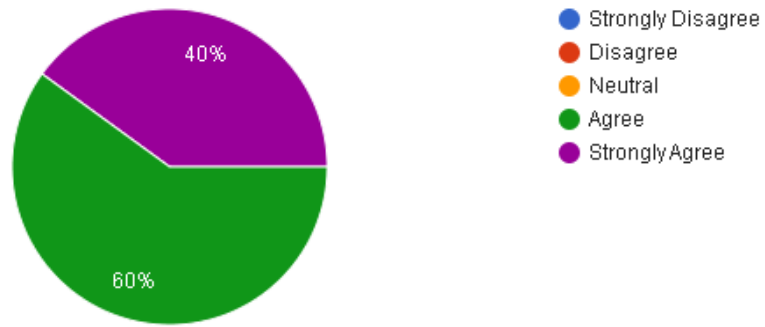
Figure 27: IT Experts Response to System's Motion Tracking Feature

Functionality = ((2*5)+(3*4)+(0*3)+(0*2)+(0*1))/5 = 4.4

The figure illustrates the responses of 5 IT Experts to a question about the functionality of the system if the motion tracking algorithms are precise and reliable. The 40% strongly agreed that the motion tracking feature accurately records their clients' movements, while 60% agreed.

Usability (IT Experts Evaluation)

12. The application is easy to operate and manage from an administrative perspective.

5 responses

○ Strongly Disagree
○ Disagree
○ Neutral
○ Agree
○ Strongly Agree

60%

40%

Figure 28: IT Experts Response to System's Usability

Usability= ((3*5)+(2*4)+(0*3)+(0*2)+(0*1))/5 = 4.6

The figure illustrates the responses of 5 IT Experts to a question about the system's usability, testing from the administrative perspective if the system is easy to operate and manage. The results show a stark contrast, with 60% of the experts strongly agreeing with the statement and 40% agreeing.

Reliability (Fitness Coach Evaluation)

9. The application is available and operational whenever needed.

5 responses
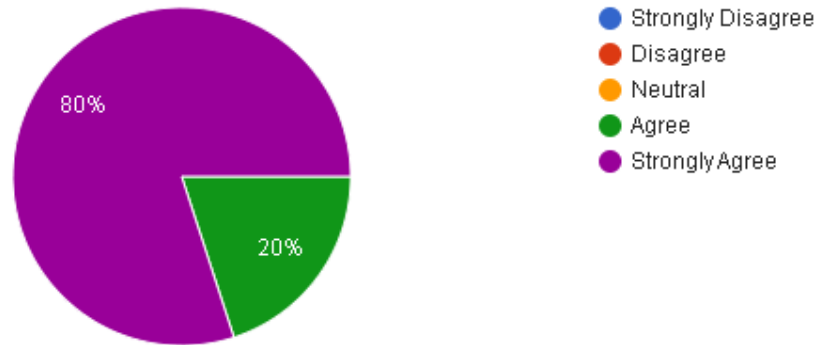
Figure 29: IT Experts response to system's Reliability

Usability= ((4*5)+(1*4)+(0*3)+(0*2)+(0*1))/5 = 4.8

The figure illustrates the responses of 5 IT Experts to a question about the reliability of the system if its available and operational whenever needed. The results show a stark contrast, with 80% of the experts strongly agreeing with the statement and 20% agreeing.

Portability (IT Experts Evaluation)

24. The installation process is straightforward and user-friendly.

5 responses

Legend:
- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree
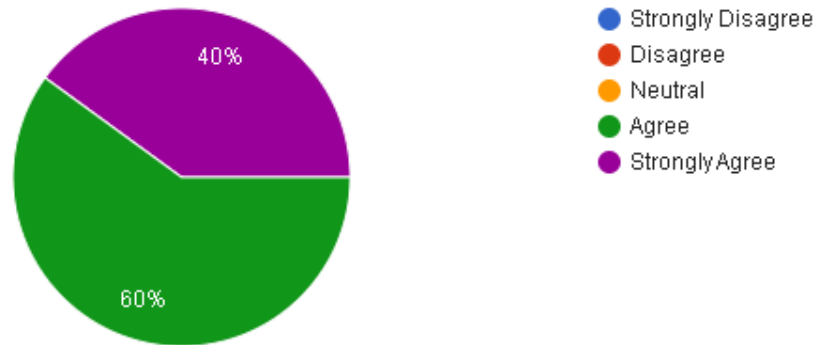
Figure 30: IT Experts response to system's Portability

Usability= ((2*5)+(3*4)+(0*3)+(0*2)+(0*1))/5 = 4.4

The figure illustrates the responses of 5 IT Experts to a question about the portability of the system, testing if it is straightforward and user-friendly. The results show a stark contrast, with 40% of the coaches strongly agreeing with the statement and 60% agreeing.

Maintainability (IT Experts Evaluation)

19. Modifications and updates to the application can be made with minimal effort.

5 responses

Figure 31: IT Experts Response to System's Reliability

Usability= ((3*5)+(2*4)+(0*3)+(0*2)+(0*1))/5 = 4.2

The figure illustrates the responses of 5 users to a question about the maintainability of the system, checking if modifications and updates can be done with minimal effort. The results show a stark contrast, with 60% of the experts strongly agreeing and 40% just agreeing with the statement.

Efficiency (IT Experts Evaluation)

15. The application's response time is satisfactory.

4 responses

Figure 32: IT Experts Response to System's Efficiency

Usability= ((2*5)+(2*4)+(0*3)+(0*2)+(0*1))/4 = 4.5

The figure illustrates the responses of 5 fitness coaches to a question about the efficiency of the system's response time. The results show a positive response, with 50% of the experts strongly agreeing that the application performs well, and other 50% agreeing.

Table 13: Fitness Enthusiast Evaluation Result

Fitness Enthusiast Evaluation Result		
Component	**Weighted Mean**	**Responses**
A. Functionality	4.35	Agree
B. Reliability	4.1	Agree
C. Usability	4.34	Agree
D. Efficiency	4.5	Agree
E. Maintainability	4.24	Agree
F. Portability	4.41	Agree
TOTAL	**4.32**	**Agree**

The table "Fitness Users Enthusiast Result" provides a detailed analysis of user feedback on various aspects of a fitness application. The evaluation covers six key components: Functionality, Reliability, Usability, Efficiency, Maintainability, and Portability. Each component's performance is quantified by a weighted mean score, accompanied by a general user response of "Agree."

Table 14: Fitness Enthusiasts Evaluation Result Mean Summary

Statement	SA (5)	A (4)	N (3)	D (2)	SD (1)	Frequency	Mean	Response
1. The application provides all the features I need for my fitness activities.	11	10	3			25	4.3	Agree
2. The motion tracking feature accurately tracks my movements.	14	7	3			25	4.4	Agree
3. The application integrates well with other fitness devices and apps I use.	6	15	4			25	4.8	Agree
4. I feel that my personal and fitness data are secure in this application.	12	9	4			25	4.3	Agree
5. The reward system includes a variety of challenges and goals.	5	14	6			25	3.9	Agree
6. I am satisfied with the overall functionality of the application.	6	13	4			25	4.1	Agree
7. The application runs smoothly without crashing.	12	8	5			25	4.2	Agree

8. The application performs well even when there are minor errors.	5	15	5			25	4.0	Agree
9. If the application crashes, it recovers quickly without data loss.	6	12	5	1	1	25	3.8	Agree
10. I can rely on the application for accurate and consistent performance.	11	10	4			25	4.2	Agree
11. The instructions and interface are easy to understand.	14	10	1			25	4.5	Agree
12. I found it easy to learn how to use this application.	14	10	1			25	4.5	Strongly Agree
13. The application is easy to use during my workouts.	17	7	1			25	4.6	Strongly Agree
14. The design and layout of the application are visually appealing.	13	4	4	1		25	4.1	Agree
15. The help and support features are helpful and accessible.	13	4	7	1		25	4.3	Agree

16. I can customize the application to fit my personal fitness needs.	6	11	6	1		25	3.9	Agree
17. The application responds quickly to my inputs.	11	11	3			25	4.3	Agree
18. The application does not drain my device's battery quickly.	7	9	8			25	3.8	Agree
19. The application performs well without slowing down my device.	7	11	6	1		25	3.9	Agree
20. I am able to easily understand any issues or errors I encounter.	6	14	5			25	4.0	Agree
21. Updates and changes to the application are smooth and trouble-free.	8	16	1			25	4.2	Agree
22. The application's features can be easily tested for functionality.	12	11	2			25	4.4	Agree
23. The application works well on all my devices (e.g., phone, tablet).	15	7	3			25	4.4	Agree

24. Installing the application was easy and straightforward.	13	11				25	4.4	Agree
25. The application is compatible with different operating systems.	10	11	3	1		25	4.1	Agree
26. Upgrading to new versions of the application is easy and smooth.	17	6	2			25	4.6	Strongly Agree

The Fitness Enthusiasts evaluation survey consisted of twenty-seven (25) questions, as illustrated in the table above. The mean score for each question was calculated, with the majority of responses being "Agree."

Functionality (Fitness Enthusiast Evaluation)

2. The motion tracking feature accurately tracks my movements.

24 responses
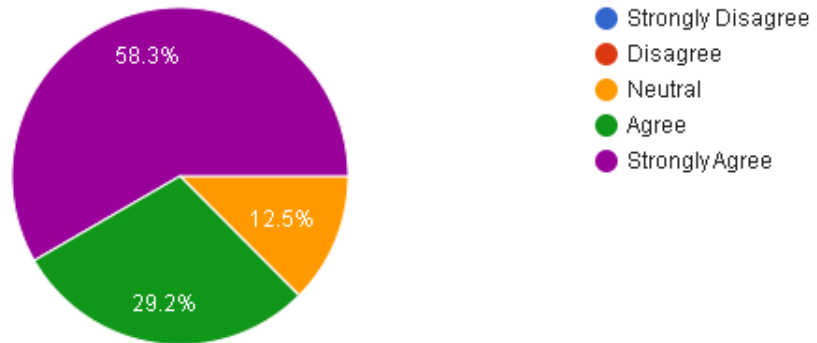
Figure 33: Fitness Enthusiast Response to System's Motion Tracking Feature

Functionality = ((14*5)+(7*4)+(3*3)+(0*2)+(0*1))/25 = 4.6

The figure illustrates the responses of 25 fitness enthusiast to a question about the accuracy of the motion tracking feature in a system they use. The majority (58.3%) strongly agreed that the motion tracking feature accurately records their movements, while (29.2%) agreed and other (12.5) voted neutral.

Usability (Fitness Enthusiast Evaluation)

11. The instructions and interface are easy to understand.

25 responses
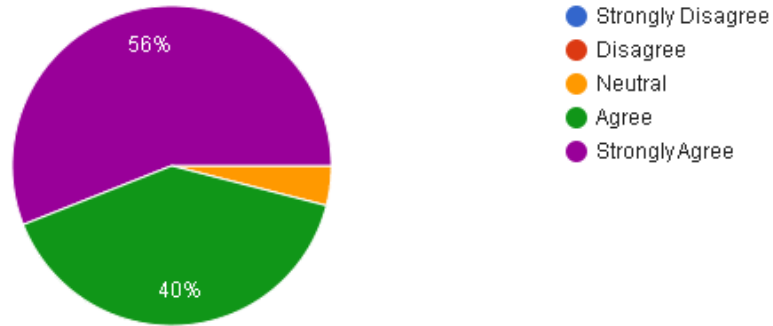
Figure 34: Fitness Enthusiast Response to System's Usability

Usability= ((14*5)+(10*4)+(1*3)+(0*2)+(0*1))/25 = 4.52

The figure illustrates the responses of 25 fitness enthusiast to a question about the system's interface and instruction whether it is easy to understand or not. The results show a stark contrast, with 56% of the enthusiast strongly agreeing, 40% agreeing with the statement and 4% voting neutral.

Reliability (Fitness Enthusiast Evaluation)

10. I can rely on the application for accurate and consistent performance.

25 responses
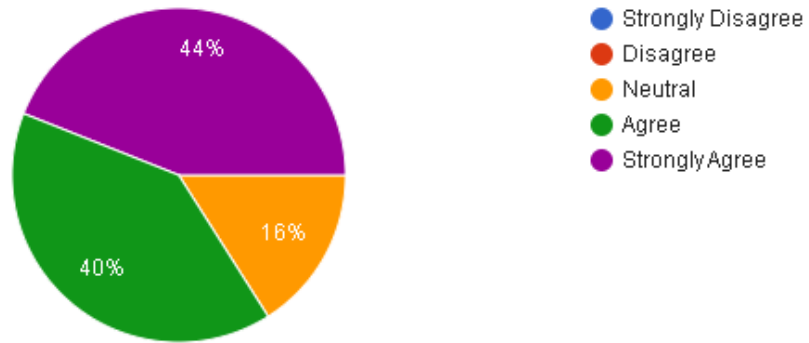
Figure 35: Fitness Enthusiast Response to System's Reliability

Usability= ((11*5)+(10*4)+(4*3)+(0*2)+(0*1))/25 = 4.28

The figure illustrates the responses of 25 fitness enthusiast to a question about the reliability of the system accuracy and consistent performance. The results show a stark contrast, with 44% of the users strongly agree and 40% agree with the statement and 16% others voted neutral.

Portability (Fitness Enthusiast Evaluation)

24. Installing the application was easy and straightforward.

25 responses
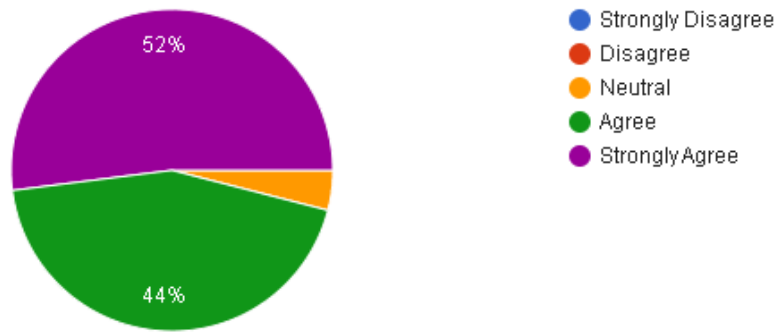
Figure 36: Fitness Coach Response to System's Portability

Usability= ((13*5)+(11*4)+(1*3)+(0*2)+(0*1))/25 = 4.48

The figure illustrates the responses of 25 fitness enthusiast to a question about the portability of the system, testing if it is easy to use and straightforward. The results show a stark contrast, with 52% of the users strongly agreeing, 44% agreeing with the statement and 1% voted neutral.

Maintainability (Fitness Enthusiast Evaluation)

22. The application's features can be easily tested for functionality.

25 responses
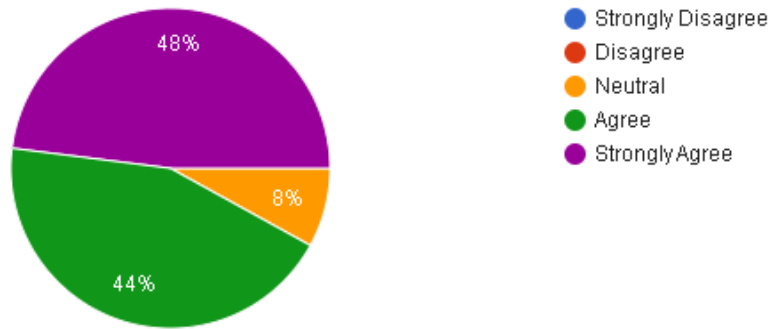
Figure 37: Fitness Enthusiast Response to System's Maintainability

Usability= ((12*5)+(11*4)+(2*3)+(0*2)+(0*1))/25 = 4.4

The figure illustrates the responses of 25 fitness enthusiast to a question about the maintainability, checking if the system's features can be easily tested for functionality. The results show a stark contrast, with 48% of the users strongly agreeing, 44% just agreeing with the statement and 8% remaining neutral.

Efficiency (Fitness Enthusiast Evaluation)

17. The application responds quickly to my inputs.

25 responses
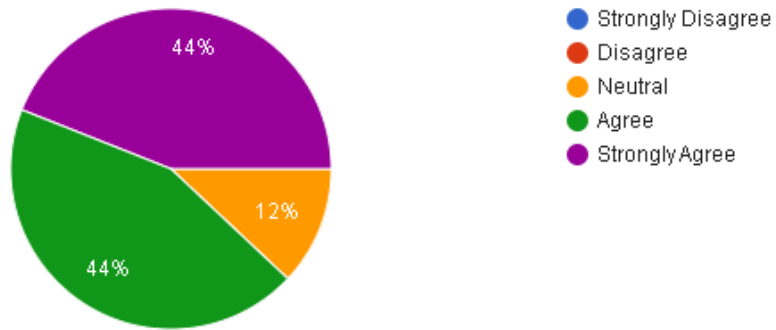
Figure 38: Fitness Enthusiast Response to System's Efficiency

Usability= ((11*5)+(11*4)+(3*3)+(0*2)+(0*1))/5 = 4.32

The figure illustrates the responses of 25 fitness enthusiast to a question about how the system responds quickly to their inputs. The results show a positive response, with 44% of the users strongly agreeing that the application performs well, and 44% agreeing and the other 12% voting neutral.

TABLE 15: OVERALL EVALUATION RESULT

OVERALL EVALUATION RESULT		
Respondents	**Weighted Mean**	**Responses**
Fitness Enthusiasts	4.32	Agree
Fitness Coach	4.27	Agree
IT Experts	4.40	Agree
TOTAL	4.33	Agree

The table above shows the calculated total weighted mean for the respondents comprised of Fitness Enthusiasts, Fitness Coaches, and IT Experts. For the Fitness Enthusiasts, it shows that its weighted mean is 4.32 while for the Fitness Coaches, the weighted mean is 4.27. Lastly, the IT Experts have a weighted mean of 4.40. All values correspond to the response of "Agree." Calculating the average weighted mean for these three types of respondents, it resulted in 4.33, which means that all respondents agree with the system.

4.2 Summary of Findings

In this part of the report, a summary of the general findings is presented, which were primarily derived from the information obtained during the post survey activities.

1. Using the Survey Questionnaire, a quantitative analysis was performed on the quality of the FitQuest system based on the components of the ISO 9126 Software Quality Model. These components include functionality, reliability, usability, efficiency, maintainability, and portability. The evaluation was conducted among three groups: Fitness Enthusiasts, Fitness Coaches, and IT Experts. The overall quality of the system, based on the six components, was evaluated as "Agree" by the Fitness Enthusiasts and Fitness Coaches, and as "Strongly Agree" by the IT Experts. The average weighted mean across all respondent groups is 4.33, which corresponds to the response "Agree." This result indicates an overall agreement among all respondent groups regarding the system's quality, with IT Experts showing the highest level of satisfaction.

2. On the basis of the aggregated findings of the system evaluation carried out by Fitness Enthusiast, Fitness Coach, and IT Experts, it has been demonstrated that the proposed system was successful in accomplishing its general and specific objectives. These include having the following features:

   a. Establish a Realtime Database for storage and retrieval of data;

   b. Login and Registration form both Web and Mobile application;

   c. Ability to edit User profile information

d. Build an admin dashboard that oversees members and rewards information.

e. Incorporate motion tracking module to detect user's exercise motion.

f. Integrate customizable reward system module

g. Integrate BMI Calculator to determine Users Body Mass Index.

Chapter 5

CONCLUSION

The researchers aim to design and develop a fitness-oriented web and mobile application system that incorporates gamification to improve motivation of gym members. The researchers also aim to conduct numerous tests to ensure the system works as intended by the researchers.

Based on the discussions and results of the previous chapter, the researchers were able to develop the system that meets their objectives.

1. **To incorporate motion tracking API within the application, which will be used to detect the user's exercise motions.**

   The researchers utilized Sency Motion API which specialized in enabling mobile application software to incorporate a motion tracking functionality which greatly helped in developing the application.

2. **To incorporate a library of different exercise motions which will be used by the system as reference for correct and proper forms when exercising.**

   The system uses Sency Motion's exercise library to determine if the user is engaging in the exercise with proper form. This allows the app to provide real-time feedback and scores to the user, helping them improve their technique and get the most out of their workouts.

3. **To design and develop a customizable reward system module and enable the system administrator to set up the claimable rewards and its cost in terms of points.**

The researchers developed a web application that serves as the admin dashboard for the system. This admin dashboard enables administrators to manage rewards which helps in incentivizing gym members to engage with the mobile application and conduct workout sessions that promotes proper form and motion for different exercises.

4. **To design and develop a weight progress monitoring module which will provide a visual representation of the user's weight progress and view a list of rewards that can be claimed.**

The researchers designed and developed a daily progress tracker module which enables users to see a visual representation of their previously done workouts. The researchers also enabled mobile users to view a list of rewards created by the administrator.

5. **To develop a BMI calculator module to inform the user of their BMI and classification (healthy, overweight, underweight).**

The researchers integrated a BMI calculator for both the web and mobile application which enables users to input their height, and weight. The calculator outputs the user's BMI as well as its classification.

6. **To test the system using ISO 9126 to ensure the quality of the project is up to the international standard.**

The researchers used ISO 9126 in the creation of their evaluation instrument. The standard was able to contribute in evaluating the overall quality and functionality of the system.

Chapter 6

RECOMMENDATIONS

In developing the fitness-oriented gamified application, the researchers identified several key areas for improvement that could be valuable for future researchers and developers seeking to create similar applications. Based on user feedback and observations during testing, the following recommendations are made.

In fitness, it is important to keep track of one's progress in order to visually see the progress and improvements throughout their journey. The researchers recommend expanding upon the progress tracking module of the app by incorporating additional progress tracking features. Tracking of exercise frequency, duration, intensity, calories burned, and personal records should be considered. Additionally, achievements, badges, leaderboards, and challenges should further motivate users and encourage long-term engagement with the app.

Implementing real time form correction during an exercise will be an extremely valuable addition to the list of features of the application. Correcting the user's form in real time can help in ensuring proper form is being maintained in an effective manner.

In addition to the existing mobile application, the researchers propose developing a version specifically designed for Apple's iOS operating system to reach a broader audience and increase user accessibility.

By considering these recommendations, future researchers and developers can build upon the foundation laid by this study and create even more effective and engaging fitness-oriented gamified applications that promote healthy lifestyles and encourage sustained physical activity.

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APPENDICES

APPENDIX A: Transcript of Interview (Gym Owner)

This interview was conducted at Lena Fitness Gym at Bocaue Bulacan, Philippines. The interviewee owns the gym and is responsible for supervising gym management processes.

Question 1: What is your name?

Hi, my name is [REDACTED for privacy purposes].

Question 2: What is your profession?

I own this gym (Lena Fitness Gym), and I check in every now and then.

Question 3: Tell me about Lena Fitness Gym.

I would say it's a traditional gym where people can train and be the best version of themselves.

Question 4: What would you say is the size of your customer base?

I am not sure, but I think we have around 30 – 50 consistent customers here.

Question 5: Do you believe that motivation plays a big role in exercise consistency?

Absolutely, motivation is like fuel for lifters and gym goers. It is very important to be motivated if you want to stay consistent.

Question 6: When it comes to exercising, what are some things that you can think of that may cause a gym goer to lose motivation?

A lack of visible results and maybe they think that their progress is just not enough, which could make them lose motivation.

Question 7: Are you open to implementing technology in your gym to help motivate customers?

Yes, I would say so.

Question 8: Do you believe a reward system can help retain your customer-base at this gym?

I think it can work for customers who like to be rewarded for their efforts.

Question 9: Are you willing to provide physical rewards to customers that are consistent with exercising?

We reward customers with tank tops if they are able to invite five friends to join them in the gym so yes, I am willing to provide physical rewards.

Question 10: On a scale of 1 – 10, How confident are you that offering rewards can positively impact your community of customers?

I'll give it a 9 out of 10.

Question 11: Are there any specific rewards that you can think of that may influence the gym goers to stay in this gym as a customer?

Tank tops and gym accessories as well as supplements can be pretty good rewards for customers.

APPENDIX B: Transcript of Interview (Gym Manager)

This interview was conducted at Lena Fitness Gym at Bocaue Bulacan, Philippines. The interviewee manages the gym and is responsible for various gym management processes.

Question 1: What is your name?

My name is [REDACTED for privacy purposes], thirty-four years old.

Question 2: How do you manage gym attendance?

We have an attendance sheet. Upon checking in at the establishment, customers will manually log their attendance by writing.

Question 3: Have you implemented a reward system in your gym before?

Yes, we did. Customers were rewarded with free sandos (tank tops) if they were able to invite five friends to join them in the gym.

Question 4: On a scale of 1 – 10, How open are you to implementing a reward system at this gym?

I have to say 7. Implementing a reward system would require me to consult with the owner of this gym.

Question 5: Do you believe a reward system can help retain your customer-base at this gym?

Yes, of course. I'm 99 or 100% sure that this is true.

Question 6: Are you willing to provide physical rewards to customers that are consistent with exercising? This includes sandos and shakers.

Yes, very much so. These rewards "boosts" the customers to be more diligent.

Question 7: On a scale of 1 – 10, How confident are you that offering rewards can positively impact your community of customers?

I'm 99% confident.

Question 8: Are there any specific rewards that you can think of that may influence the gym goers to stay in this gym as a customer?

Gym accessories like belts, straps, shakers, and supplements can be a very good reward for them.