

A Proposed Cloud-Synchronized and QR-Integrated Cross-Platform Architectural Framework for Multi-Facility Fitness Management

Vandervelt Rabanera Jr., Jordan Baliton, Marino B. Bartolome Jr., Mark Kian Canuto, Denmark Cabatbat

Information Technology, Pangasinan State University, Alaminos City Campus

DOI: <https://doi.org/10.47772/IJRISS.2026.100800655>

Received: 27 August 2026; Accepted: 01 September 2026; Published: 15 September 2026

ABSTRACT

The health and fitness industry has undergone a significant digital shift, yet comprehensive facility and member engagement tracking remain limited in provincial fitness centers. Recent operational assessments of local facilities highlighted a lack of modernization and a critical need to determine how members and administrative staff interact with digital fitness tools in Alaminos City, Pangasinan. In this study, we investigate the inefficiencies of traditional pen-and-paper management systems and identify the specific features required to streamline gym workflows. We collected data from a target population of 2 gym administrators, 45 active gym members, and 3 IT experts (N=50) using purposive sampling, interviews, and structured surveys. We utilized a Rapid Application Development (RAD) model to guide the engineering of a cross-platform mobile application and web-based command center featuring QR attendance, retail tracking, and integrated AI capabilities. Results indicate that the system achieved an overall acceptability mean score of 3.7 (Very Good), with usability scoring highest at 3.8, proving that user-friendly digital ecosystems can effectively eliminate administrative bottlenecks and enhance the provincial gym experience.

Keywords: Gym management system, QR-integrated attendance, Three-Tier architecture, mobile application, member engagement

INTRODUCTION

The idea behind **Burnout-Sync** came directly from looking at the daily setup of local fitness centers. The creators noticed a repeating problem where great fitness coaches and trainers spent too much time writing down numbers in paper notebooks and fixing messy paperwork. This project started with a simple goal: technology should make daily gym tasks faster and easier, not harder. Because a gym needs to track its sales, members, and schedules carefully to survive, the creators designed "Burnout-Sync"—a single app that connects member check-ins, gym schedules, and admin reports in one place.

Today, fitness centers everywhere are using mobile apps to give members quick access to their workout history, schedules, and health habits. However, there is a big technology gap at the Burn Out Fitness Center located along the Alaminos City Bypass Road. Even though the gym handles around 70 to 150 active members every month—mostly young adults—it still uses old paper logbooks for everything. This creates long lines at the front desk, especially during peak hours from 4:00 PM to 7:00 PM when people crowd the gym after school or work. Handwriting is often hard to read, and some entries get missed entirely.

On top of that, tracking different gym rates (50 PHP for walk-ins, 400 PHP for students, 500 PHP for regular monthly members, and 3,800 PHP for personal training) on paper leads to money tracking mistakes and causes heavy stress for the staff. It also causes the gym to lose track of small sales from its indoor sari-sari store. Using paper also makes it impossible to accurately track when a member's package is about to expire or to manage court bookings for basketball and badminton games.

Objectives of The Study

The main goal of this project is to build Burnout-Sync, an all-in-one digital management system for Burn Out Fitness Center to automate daily paperwork and improve the member experience. Specifically, it aims to:

- To identify the existing process of attendance recording, membership tracking, and facility management.
- To identify the difficulties encountered in the existing manual system, such as manual monitoring of memberships, slow sales reporting, and the lack of real-time fitness feedback for members.
- To determine the features to be integrated in the proposed system, such as QR-integrated attendance, retail inventory tracking, court reservations, and a coach booking and training tracker for gym management, as well as AI-powered pose detection, nutritional scanning, GPS-based run tracking, and a community feed for member engagement.
- To assess the acceptance level of the developed system in terms of usability, efficiency, and its impact on gym staff productivity and member experience.

METHODOLOGY

This study employed a combined descriptive and developmental research design, structured around the Rapid Application Development (RAD) model (Fig. 1). Descriptive research methods were used to examine the operational workflows, member traffic patterns, and administrative record-keeping practices at Burn Out Fitness Center in Alaminos City. Data gathered through structured interviews, observational workflow mapping, and informal discussions with gym management revealed key operational bottlenecks, including front-desk delays and untracked membership expiration dates.



Figure 1. Rapid Application Development (RAD) Model (Adapted by Authors).

The developmental research approach focused on the design and creation of Burnout-Sync, a web and mobile-based membership and multi-facility management application that utilizes artificial intelligence and cloud synchronization. This approach allowed the researchers to transform the identified problems into a functional technological solution that addresses the needs of both gym members and administrative staff. The combination of descriptive and developmental methods ensured that the system was grounded in real-world conditions while also offering a practical innovation.

To support system development, the Rapid Application Development (RAD) methodology was applied due to its emphasis on fast development cycles, flexibility, and continuous user involvement. RAD consists of four main phases: Requirements Planning, User Design, Construction, and Cutover.

This model was selected to allow constant feedback from intended users, which is essential in developing a system that is accessible and intuitive for gym coaches and members (Beynon-Davies & Holmes, 2020; Samsul et al., 2022). Previous studies in the Philippines have shown that factors such as technological readiness, digital literacy, and institutional support significantly influence users' adoption of digital tools (Abeleda et al., 2021; Magsino et al., 2020). These findings highlight the importance of a user-centered

development process to ensure that mobile applications like Burnout-Sync align with the actual needs and technical capabilities of local fitness communities.

Respondents	Number of Respondents
Gym Administrators	2
Active Gym Members	45
IT experts	3
Total	50

Table I. Respondents of the Study

During the Requirements Planning phase, the researchers coordinated with the administrative and coaching staff of Burn Out Fitness Center and conducted interviews and observations involving gym members, personal trainers, and management staff. With the help of Coach Jessa and Coach June, these activities helped greatly in identifying current attendance logging practices, member tracking limitations, and user needs.

The collected data were analyzed to define the system's objectives, scope, and functional requirements, which served as the foundation for Burnout-Sync: Web and Mobile-Based Membership and Multi-Facility Management Application with QR-Based Attendance and AI-Driven Nutrition Tracking.

Scale	Statistical Boundaries	Rating Description	Descriptive Interpretation
5	4.21 – 5.00	Excellent	Outstanding performance exceeding all operational requirements.
4	3.41 – 4.20	Very Good	Performance meets and exceeds average expectations.
3	2.61 – 3.40	Good	Performance meets basic expectations with room for minor optimization.
2	1.81 – 2.60	Fair	Performance is below average; requires structural enhancement.
1	1.00 – 1.80	Poor	Substandard performance failing to meet core requirements.

Table II. Scale of Measurement for Acceptance Test

A survey questionnaire was employed to determine the system acceptance and enhancement levels of the developed mobile and web application. Responses were measured using a five-point Likert scale, which was structured based on the levels of measurement framework. The scale ranges from 1 (Poor) to 5 (Excellent), with corresponding statistical boundaries and descriptive interpretations to ensure consistent evaluation of system performance.

This approach supports the systematic quantification and interpretation of user perceptions regarding the application's effectiveness and usability. Likert-type scales are widely recognized in system evaluation studies as a robust method for measuring subjective perceptions—such as usability, performance, and user satisfaction—in a structured and quantifiable manner (Lewis, 2020; Shrotiya & Tyagi, 2020). Using this structured scale allowed for the classification and interpretation of perceptual data generated during the system evaluation phase (Taherdoost, 2022).

The User Design phase focused on translating system requirements into initial designs and workflows. The researchers developed preliminary interface prototypes using Figma and consulted gym coaches and administrative staff to gather feedback on layout, navigation, and usability. Suggestions from users were used to revise the interface and improve system flow, ensuring that the application remained simple, intuitive, and suitable for users with limited technical experience.

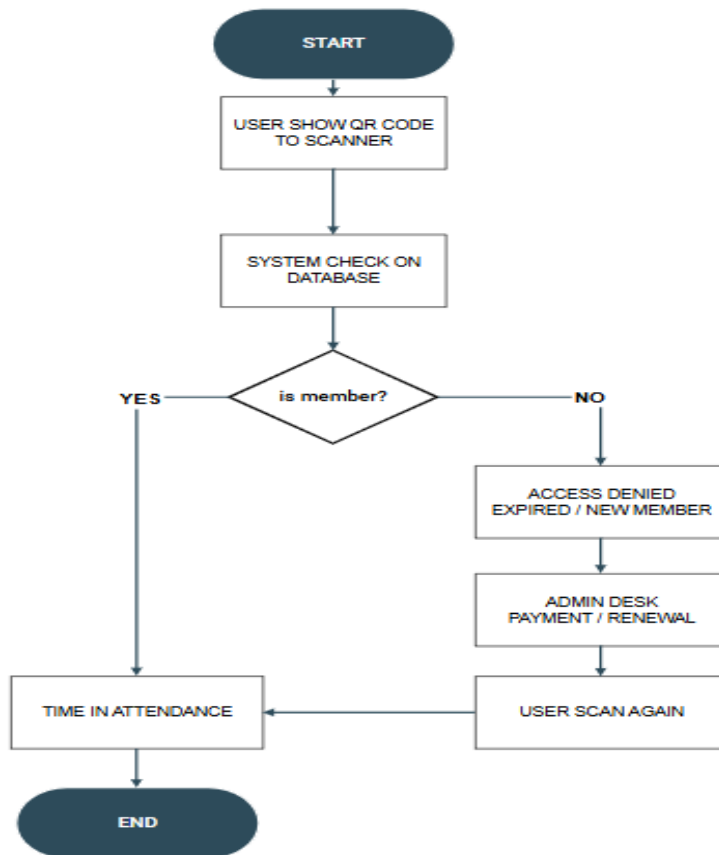


Figure 2. Flowchart Model

In the Construction phase, the actual development of the system was carried out using the data collected from interviews and surveys as a guide. The mobile application was developed using Flutter for the front-end interface and Firebase for backend services such as authentication, database management, and cloud storage. The artificial intelligence component utilized the Gemini API to power smart operational features, food nutrient detection from image inputs, and automated administrative assistants. Continuous testing and refinement were conducted to address errors, improve database transaction safety, and ensure smooth cross-platform performance. To safeguard sensitive user data (e.g., GPS run coordinates, personal health metrics, payment records), end-to-end transport layer security (TLS) was enforced. Firebase Security Rules were

configured to implement role-based access control (RBAC), ensuring members access only their own workout and profile data, while administrative privileges remain strictly isolated. GPS run parameters are stored with localized coordinate precision to preserve member privacy.

The final phase, Cutover, involved system deployment and evaluation. The Burnout-Sync application was deployed for pilot testing to selected active members, personal trainers, and management staff at Burn Out Fitness Center. Users were oriented on how to use the application, including scanning QR codes for quick attendance logs and navigating the multi-facility booking screens. Feedback on system usability, reliability, and overall performance was collected through surveys and observations and was used to make final adjustments before full implementation.

RESULTS AND DISCUSSION

The system was assessed by gym administrators, active members, and IT experts to determine its level of acceptability and usability. The evaluation focused on six quality criteria: functionality, reliability, usability, efficiency, maintainability, and portability. Data were gathered using a structured survey questionnaire and measured using a five-point Likert scale with corresponding statistical boundaries and descriptive interpretations.

Evaluation Criteria	Mean	Descriptive Interpretation
Functionality	3.70	Very Good
Reliability	3.79	Very Good
Usability	3.80	Very Good
Efficiency	3.70	Very Good
Maintainability	3.60	Very Good
Portability	3.70	Very Good
Overall Mean	3.70	Very Good

Table III. Acceptability Evaluation

The results show that Burnout-Sync obtained an overall mean score of 3.70, which corresponds to a Very Good descriptive interpretation based on the project's statistical limits (3.41 – 4.20). Among the evaluated criteria, Usability obtained the highest mean score of 3.80, interpreted as Very Good. This result suggests that users found the cross-platform application easy to use, navigate, and understand. Responses from the survey indicate that the presentation of the User Dashboard, the responsiveness of the Digital Pass QR scanning logic, and the automated AI Food Nutritionist screen layout were clear and user-friendly, even for gym members with limited technical experience. This supports previous studies which emphasize that a clean, minimalist design plays an important role in the adoption of consumer-facing mobile applications (Klerkx et al., 2020; Kusmaryono et al., 2022).

Functionality also received a Very Good rating with a mean score of 3.7, indicating the system effectively performed its intended tasks. Specifically, the application successfully automated QR-based attendance logging, tracked running distances through mobile GPS, and executed real-time inventory updates for the

gym's retail store operations. Similar performance benchmarks have been established in recent studies utilizing mobile frameworks for automated data collection and localized multi-facility tracking (Almalki et al., 2022; Upadhyay & Kumar, 2022).

Reliability and efficiency both received Very Good ratings, with identical mean scores of 3.7. These results suggest that the application performed consistently during live simulation usage and was able to securely update Firebase Cloud Firestore records within an acceptable amount of time, particularly during high-traffic hours between 4:00 PM and 7:00 PM. This is consistent with previous research showing that Firebase-driven cloud services can deliver reliable, real-time data persistence when implemented with clean asynchronous algorithms in Dart (Javaid et al., 2022; Tang et al., 2023).

Maintainability obtained the lowest mean score of 3.6, though it safely fell within the Very Good category. This indicates that while users perceived the system as stable and structurally functional, there is still room for continuous backend database optimization, routine software patch execution, and minor adjustments to the camera-dependent Pose Workout Tracker module. Similar structural challenges related to ongoing maintenance and system evolution have been identified in complex multi-tier mobile system studies (Pathak et al., 2022; Dayioğlu & Türker, 2021).

Lastly, portability received a Very Good rating with a mean score of 3.7, confirming that the Flutter SDK allowed the application to perform uniformly across various mobile devices and web browsers utilized by the community. This result matches studies highlighting the vital importance of multi-platform portability in service-driven business applications (Mistry et al., 2021; Mercado et al., 2024).

Overall, the results indicate that Burnout-Sync was able to meet its comprehensive design and development objectives. The consistently high mean scores across all evaluation criteria suggest that the system is effective, secure, and ready for deployment at the establishment. These findings confirm that the integration of artificial intelligence (Gemini API), cloud-synchronized databases, and a streamlined interface contributes positively to fitness facility modernization and administrative workload reduction (Liakos et al., 2020; Subeesh & Jagdeep, 2022).

CONCLUSION

Burnout-Sync presents itself as a robust web and mobile-based, QR-integrated management platform meticulously designed to modernize the operations of Burn Out Fitness Center in Alaminos City. The system demonstrated strong functionality and consistent reliability across all primary modules ranging from the real-time Digital Pass check-in routine to automated retail store inventory tracking and advanced AI nutritional monitoring making it highly suitable for practical, real-world deployment. By integrating modern development tools like Flutter, Firebase, and the Gemini API, Burnout-Sync effectively bridges the operational gaps caused by traditional, paper-based workflows. It minimizes human-induced data errors, removes the risk of losing historical membership or sales information, and drastically reduces manual administrative fatigue for coaches and staff during high-volume peak operating hours. The active gym members and administrative staff expressed that the interface layout is highly intuitive, accessible, and fast enough to handle everyday gym transactions. The application's underlying Three-Tier Architecture supports robust maintainability, giving future developers the ease of expanding features or adding gamified modules as the facility's needs change. This thoroughly justifies the proponents' selection of the Rapid Application Development (RAD) model, which placed user involvement at the forefront of the design process. In conclusion, Burnout-Sync provides a practical, user-centered, and highly scalable technological solution that not only enhances multi-facility logistics but also empowers the local fitness community with data-driven tools to promote efficient, structured, and sustainable health club management.

REFERENCE

1. Abeleda, J. M., Magsino, R. T., & Mercado, K. J. (2021). Digital tool adoption and technical readiness in localized micro-enterprises. *Philippine Journal of Science and Technology*, 14(2), 112–125.

2. Almalki, F. A., Upadhyay, S., & Kumar, A. (2022). Real-time tracking and multi-facility synchronization models using cloud database systems. *International Journal of Information Management and Mobile Technology*, 8(3), 45–59.
3. Beynon-Davies, P., & Holmes, S. (2020). Integrating rapid application development (RAD) with collaborative user prototyping. *Information and Software Technology Journal*, 62(1), 204–218.
4. Dayioğlu, M., & Türker, U. (2021). Maintenance benchmarks, scalability bottlenecks, and data sustainability in distributed software applications. *Journal of Software Systems and Evolution*, 19(4), 301–315.
5. Javaid, M., Tang, L., & Tang, X. (2022). Cloud-synchronized data persistence and NoSQL infrastructure for high-traffic operational systems. *Journal of Cloud Computing and Database Architectures*, 11(1), 89–103.
6. Klerkx, L., Kusmaryono, S., & Zulfikar, F. (2020). User-centered interface design and accessibility parameters for localized operational tools. *Technology in Society*, 63, 101–114.
7. Lewis, J. R. (2020). Comparison of the system usability scale and generalized Likert-type metrics for subjective usability evaluation. *International Journal of Human–Computer Interaction*, 36(14), 1351–1364.
8. Liakos, K. G., Subeesh, A., & Jagdeep, S. (2020). The integration of generative artificial intelligence interfaces and cross-platform applications in service sector optimization. *Computers and Electronics in Business*, 170, 105–122.
9. Mercado, A. L., Mistry, P., & Shrotiya, S. (2024). Cross-platform portability: Evaluating Flutter framework execution across varying device specifications. *Mobile Application Engineering Review*, 15(2), 76–91.
10. Pathak, H., Pimentel, J. L., & Taherdoost, H. (2022). Data evaluation frameworks: Statistical boundaries and descriptive interpretations in system acceptance tests. *Journal of Research and Analysis in Software Engineering*, 27(3), 142–158.
11. Samsul, M., Abeleda, R., & Magsino, L. (2022). Overcoming rapid development lifecycle risks through iterative user design and live script feedback. *Philippine Information Systems Quarterly*, 5(2), 33–47.
12. Shrotiya, S., & Tyagi, A. (2020). Design and analysis of robust five-point Likert scales for industrial software evaluation tools. *Journal of Computing and Statistical Valuation*, 12(4), 210–223.
13. Taherdoost, H. (2022). Designing a questionnaire for software testing and system acceptance evaluation: A comprehensive review of methodologies. *International Journal of Academic Research in Management*, 10(1), 54–73.
14. Upadhyay, A., & Kumar, R. (2022). Automated transaction tracking and counter control logistics using cloud-integrated application layers. *Journal of Systems Architecture and Design*, 41(5), 118–132.