# An Integrated Fitness Decision Support System with Personalized Workout Recommendation Using Decision Tree–K-Nearest Neighbors Hybrid Approach

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***Abstract***

This study developed an integrated web-based gym management and personalized fitness recommendation system using a hybrid Decision Tree and K-Nearest Neighbors (KNN) approach. The system was designed to support gym administrators, trainers, and members through centralized member management, attendance monitoring, scheduling, progress tracking, and personalized workout recommendations. The recommendation component used more than 3,258 fitness-related records, consisting of over 3,473 existing reference records and more than 215 actuals locally collected user records. The Decision Tree component classified users according to relevant fitness characteristics, while KNN refined the recommendation by identifying similar user profiles within the dataset. The system was developed using the Agile software development approach, covering planning, design, development, testing, deployment, and review. Approximately 300 respondents, including gym members, gym staffs, and individuals with gym experience, participated in the system evaluation. The hybrid recommendation model achieved a reported accuracy of 91%. Software quality was assessed using the eight characteristics of ISO/IEC 25010:2011: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. The system obtained an overall weighted mean of 4.29, interpreted as Strongly Agree, indicating a favorable evaluation from respondents. The findings show that integrating machine learning with gym management functions can support personalized workout planning, organized fitness information, and progress monitoring. The study also supports Sustainable Development Goal 3 by promoting technology-assisted physical activity, fitness self-monitoring, and health-oriented decision support. Overall, the developed platform demonstrates the practical potential of combining data-driven recommendations with digital gym operations to provide a more integrated and user-centered fitness management experience.

*Keywords: fitness decision support system; K-Nearest Neighbors; personalized workout recommendation; fitness management; SDG 3*