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DUM-BEL: Accelerating Personal Workout Training with Artificial Intelligence

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ABSTRACT

With the increasing emphasis on personal health and fitness, individuals seek accessible digital tools to track workouts, monitor progress, and maintain consistency in their fitness routines. Many existing solutions are either overly complex, require paid subscriptions, or lack customization for users who prefer independent workout management.

This paper presents DUM-BEL, a full-stack mobile application designed specifically for individual users to record, organize, and evaluate their personal fitness activities. The system allows users to log workouts, track exercise progress, and create structured workout plans. Users may design workout routines manually or utilize an AI-assisted workout plan generator that produces structured routines based on user goals and preferences.

The application follows a client–server architecture and incorporates modern mobile technologies, including a responsive front-end interface, RESTful backend services, and a cloud-hosted PostgreSQL database powered by Supabase. Functional and usability testing were conducted to evaluate system performance and reliability. The results demonstrate that DUM-BEL provides a flexible and user-centered solution for personal workout tracking and workout planning.

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1 Introduction

Advancements in digital technology have significantly influenced how individuals approach health and fitness. Mobile applications now allow users to track exercise routines, monitor performance, and maintain consistent workout schedules [1, 2]. These tools provide convenient ways for individuals to organize workouts and evaluate their progress over time.

Despite the growing number of fitness applications available, many platforms focus primarily on commercial gym management systems or require paid subscriptions for advanced functionality [3]. As a result, individuals who wish to independently manage their workout routines may encounter limitations in customization and accessibility. Another challenge is that many

fitness tracking applications focus only on recording completed workouts rather than assisting users in designing structured workout plans. For users without prior experience in fitness programming, creating an effective workout routine can be difficult without guidance or planning tools.

To address these limitations, this project introduces DUM-BEL, a mobile application workout tracking platform designed specifically for individual users. The system allows users to log exercises, track performance metrics, and create personalized workout routines. In addition to manual workout planning, the platform integrates an AI-assisted workout plan generator that automatically produces structured routines based on user goals and preferences [4, 7]. This dual approach allows users to either construct custom routines themselves or generate plans quickly using artificial intelligence.

2 Literature Review

Related Work

Several existing fitness applications provide tools for workout tracking, workout plan generation, and exercise management. These platforms demonstrate the growing demand for digital solutions that help individuals organize and monitor their fitness routines.

One popular workout tracking application is Hevy, which allows users to log exercises, track sets and repetitions, and monitor strength progress over time. Similar to the DUM-BEL platform, Hevy focuses on providing a structured interface for managing workout sessions and maintaining historical workout data [4]. However, while Hevy offers detailed tracking capabilities, its features are primarily centered around manual workout logging rather than integrating AI-assisted workout plan generation.

Another widely used application is Fitbod, which utilizes artificial intelligence to generate workout routines based on user performance and available equipment. Fitbod demonstrates how AI can assist users in creating structured workout programs without requiring deep knowledge of exercise programming. The use of AI in workout planning highlights the potential benefits of integrating intelligent systems into personal fitness platforms [5, 6].

Applications such as MacroFactor also provide tools for structured workout planning and fitness management. MacroFactor focuses primarily on nutrition tracking and workout organization, helping users balance diet and exercise to achieve fitness goals [4]. While these systems provide comprehensive fitness planning tools, they often include features beyond simple workout tracking and may introduce additional complexity for users seeking a more focused workout management solution.

Similarly, Strong is a strength-building application designed to help users track workouts, monitor progress, and organize strength-building routines [7]. Strong emphasizes efficient workout logging and progress tracking for weightlifting exercises. While it provides a streamlined interface for recording workouts, the platform primarily focuses on manual routine management rather than automated workout generation.

More advanced personal coaching platforms, such as Future, connect users with professional trainers who design personalized workout plans and provide ongoing feedback [8]. While these systems offer highly customized workout programs, they often rely on paid subscription models and direct human coaching rather than automated planning tools.

Another notable example is Zwift, which introduces gamification into fitness training by allowing users to participate in virtual cycling or running environments [7]. Zwift emphasizes motivation through interactive and competitive experiences rather than traditional workout tracking and planning.

Although these platforms demonstrate a wide range of features available in modern fitness applications, many of them either require paid subscriptions, focus heavily on specialized fitness activities, or provide limited support for AI-assisted workout planning within a lightweight workout tracking system. The DUM-BEL application aims to address these limitations by combining workout tracking, manual routine creation, and AI-assisted workout generation within a simple and accessible platform designed specifically for individual users.

Literature Review

Researchers have increasingly explored the development of digital systems to help users monitor exercise and maintain consistent physical activity. Many of these systems combine user interfaces with database technologies to store workout data and analyze performance metrics [4]. Such applications allow users to track exercises, sets, repetitions, and workout frequency over time.

Artificial intelligence has also become an important component of modern health and fitness technologies. AI-based systems are capable of analyzing user inputs and generating personalized recommendations tailored to individual fitness goals [5, 6]. These systems can simplify the process of designing workout programs while also improving user engagement. Several studies have demonstrated the potential of AI-assisted fitness platforms that automatically generate workout routines for users

based on their preferences and experience levels. Additionally, machine learning technologies have been applied to fitness tracking applications to improve workout recommendations and adapt workout programs over time [7].

Intelligent coaching systems represent another area of research where AI is used to provide structured exercise guidance and personalized workout routines [8, 9]. These systems highlight the potential for integrating AI technologies with workout tracking platforms to improve accessibility and user experience.

Problem Statement

Although many fitness applications exist today, several limitations remain for individual users. Many applications require paid subscriptions for advanced features, while others focus primarily on gym management rather than personal fitness tracking [3]. In addition, numerous platforms allow users to log completed workouts but provide limited assistance when designing structured workout routines.

Without appropriate planning tools, individuals may struggle to organize effective workout programs or maintain consistent training schedules. This challenge highlights the need for a system that combines workout tracking functionality with tools that assist users in creating structured workout plans.

System Objectives

The primary objective of the DUM-BEL system is to create a user-friendly workout tracking platform designed specifically for individual fitness users. The application aims to provide tools for recording workouts, monitoring exercise progress, and organizing structured workout routines.

Another key objective of the system is to integrate artificial intelligence into the workout planning process. By incorporating an AI-assisted workout generator, the system can help users quickly generate structured workout routines based on their fitness goals while still allowing full manual customization.

System Architecture

The DUM-BEL platform follows a client-server architecture [1], which separates the user interface from back-end processing components. In this architecture, the front-end interface communicates with back-end services responsible for handling application logic and managing user data [1]. The front-end component provides users with tools for logging workouts, viewing workout history, and generating workout plans. The back-end processes user requests and communicates with the database to store and retrieve workout information.

The application uses Supabase, a cloud-hosted back-end platform built on PostgreSQL, to manage authentication and database storage. This cloud-based infrastructure allows the system to securely store user information and scale efficiently as the number of users increases.

Database Design

The system database stores information related to users, exercises, workout plans, and workout logs. Each user account is associated with stored workout routines and historical fitness data, allowing the system to track long-term workout progress.

The database structure enables efficient retrieval and organization of workout data. By maintaining relationships between tables, the application can link exercises with specific workout sessions and generate historical performance insights.

3 Implementation Details

The implementation of the DUM-BEL system combines modern mobile technologies, a cloud-hosted back-end infrastructure, and an AI-assisted planning component to deliver a scalable workout tracking platform. The system architecture integrates a responsive front-end interface, RESTful back-end services, secure authentication mechanisms, and a PostgreSQL database managed through Supabase. These components work together to support workout logging, data storage, and automated workout plan generation.

3.1 Frontend Implementation

The front-end interface of DUM-BEL was designed with a focus on responsiveness, usability, and accessibility to ensure that users can effectively interact with the application across a variety of devices. A mobile-first design strategy was adopted to ensure optimal performance on smartphones and tablets while maintaining compatibility with larger desktop displays.

The layout is implemented using CSS Grid and Flexbox, allowing workout cards, exercise lists, and navigation elements to dynamically adjust to different screen sizes.

The application supports four primary viewport ranges: mobile devices (≤768px), tablets (769px-1024px), laptops (1025px-1440px), and desktop displays (>1440px). CSS Grid is used to maintain consistent alignment of workout cards and exercise components, while exercise media containers preserve a consistent 16:9 aspect ratio using padding-based scaling techniques. This approach ensures that exercise GIF demonstrations remain visually consistent across devices.

Accessibility was also considered during the interface design. The application follows WCAG AA accessibility guidelines by incorporating semantic HTML5 elements and ARIA attributes for interactive components. All exercise media include descriptive alternative text, and the interface maintains color contrast ratios exceeding 4.5:1 to improve readability. Keyboard navigation support enables users to move through the application without relying on a mouse, and screen reader announcements confirm actions such as successful workout creation or saved workout sessions.

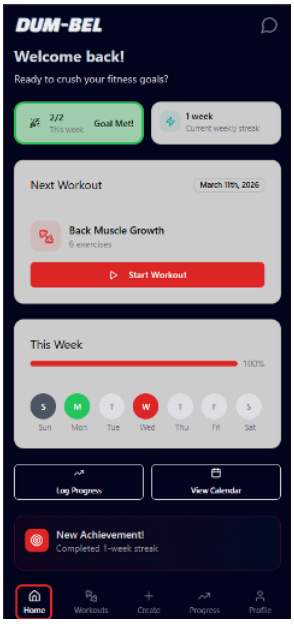

Figure 1: The DUM-BEL dashboard displays workout history, workout cards, and progress statistics.

3.2 Backend Logic and REST API Design

The backend infrastructure of DUM-BEL is implemented using Supabase, a Backend-as-a-Service (BaaS) platform built on PostgreSQL. Supabase provides several core services, including database hosting, authentication, real-time data subscriptions, and file storage. This architecture simplifies backend management while maintaining scalability and security.

Backend operations are implemented through a combination of RESTful API endpoints, database functions, and Supabase Edge Functions for complex operations. When users perform actions such as logging workouts, updating exercise data, or generating workout plans, the frontend sends requests to backend endpoints that validate the request, execute database operations, and return structured responses.

The API design follows REST principles, ensuring consistent request formats and predictable response structures. Standard HTTP status codes are used to indicate the success or failure of requests, enabling the frontend to respond appropriately to different outcomes. This modular API architecture also makes it easier to expand the system with additional features in the future.

3.3 Authentication and Authorization Mechanisms

User authentication and authorization are handled using Supabase Auth, which provides secure identity management and session handling. The application supports email-and-password authentication as well as optional OAuth providers such as Google and Apple, allowing users to quickly create accounts and sign in securely. Authentication sessions are maintained using secure HTTP-only cookies combined with automatic refresh rotation to ensure continued session validity while minimizing security risks.

To ensure proper data access control, the system uses PostgreSQL Row-Level Security (RLS) policies. RLS policies are applied to each database table to ensure that users can only access and modify their own workout data. These policies enforce strict separation of user records at the database level, preventing unauthorized access even if application logic is compromised.

In addition to RLS, the system implements a role-based access control model that defines different permission levels. Authenticated users are allowed to fully create, read, update, and delete operations on their personal workouts while maintaining read-only access to the shared exercise library. Users may optionally share workouts with friends, enabling mutual messaging and visibility of shared workout routines. Administrative accounts maintain elevated privileges that allow them to manage the exercise library and moderate shared content within the platform.

3.4 Database Schema Design

The database schema for DUM-BEL was designed to efficiently manage workout data while maintaining clear relationships between entities. The primary tables include user accounts, exercises, workout plans, and workout logs. Each user account is associated with multiple workout sessions and stored workout plans, allowing the system to track historical performance data over time.

Exercises are stored in a centralized exercise library containing information such as exercise names, descriptions, and demonstration media. Workout plans reference exercises from this library while storing additional information such as sets, repetitions, and workout order. Workout logs record completed sessions and allow users to review historical workout data and track progress.

This relational database design ensures efficient data retrieval and supports future expansion of the system, including potential analytics features and performance tracking.

3.5 Manual Workout Plan Creation

The system includes functionality that allows users to manually create workout plans by selecting exercises and defining sets and repetitions. This feature enables users to fully customize their workout routines according to their personal fitness goals and preferences.

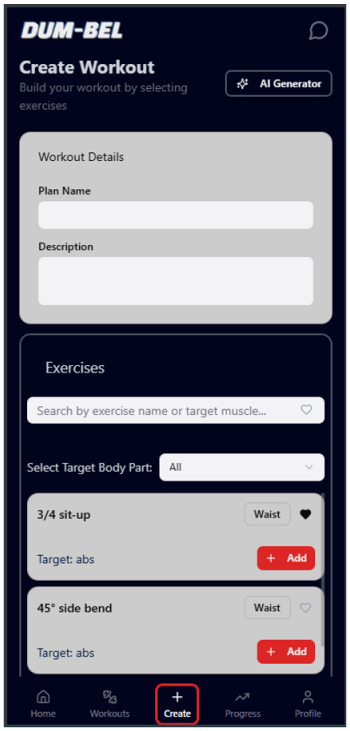

Figure 2: Interface used for manually constructing workout routines.

3.6 AI-Assisted Workout Plan Generation

To simplify workout planning, the system integrates an AI-assisted feature capable of generating structured workout routines automatically. Users can provide information such as fitness goals, workout frequency, and preferred exercise types. Based on these inputs, the AI component generates a workout plan consisting of recommended exercises and workout parameters.

This feature reduces the complexity of workout planning for users who may not have experience designing workout programs, while still allowing manual adjustments to the generated routines.

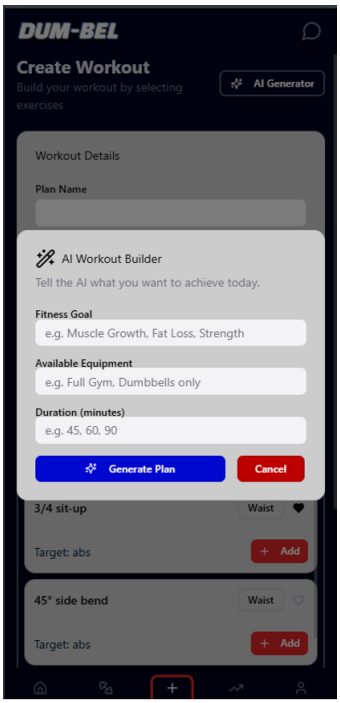

Figure 3: AI-generated workout routine based on user input parameters.

3.7 Error Handling and Input Validation

Robust error handling and input validation mechanisms were implemented throughout the system to ensure reliability and maintain data integrity. On the client side, custom error boundaries are used to prevent application crashes by gracefully handling unexpected rendering errors. Input validation occurs before requests are sent to the backend, ensuring that required fields such as exercise selections, set counts, and workout names are properly formatted.

At the API level, standardized error responses are returned using appropriate HTTP status codes and descriptive messages that help identify the cause of failures. Database operations are executed within transactions, allowing operations to automatically roll back if a constraint violation or database error occurs. This approach prevents incomplete or inconsistent data from being stored.

To improve system reliability, the application implements retry logic using exponential backoff for certain API requests, with a maximum of three retry attempts for non-mutating operations. Optimistic user interface updates are used for messaging features, allowing the interface to update immediately while maintaining the ability to revert changes if a request fails.

Monitoring tools were also integrated to track system performance and detect potential issues. Frontend errors are captured using Sentry, while backend query performance and logs are monitored through Supabase's logging infrastructure. These monitoring tools allow developers to identify performance bottlenecks and address service degradation quickly.

3.8 Testing and Evaluation

System evaluation involved functional testing to verify the reliability of core application features. Tests were conducted to ensure that user authentication worked correctly, workout data was stored and retrieved properly, and AI-generated workout plans were successfully generated and displayed.

Usability testing was also performed to determine how easily users could navigate the application and perform common tasks such as logging workouts and creating training routines. The results demonstrated that the system provides an efficient

and accessible platform for managing personal fitness data.

4 Results and Discussions

The evaluation of the DUM-BEL system focused on system performance, usability, and its effectiveness as a personal workout tracking platform. Testing was conducted to ensure that the application successfully handled key tasks such as user authentication, workout logging, workout plan generation, and database communication.

In terms of system performance, the application demonstrated stable operation during testing. User authentication through Supabase was completed quickly, and workout data was stored and retrieved from the cloud-hosted PostgreSQL database with minimal delay. The responsive front-end interface allowed users to navigate between workout records, create workout plans, and interact with the AI workout generator without noticeable latency. The use of a Backend-as-a-Service platform simplified backend operations while maintaining reliable performance during testing.

User satisfaction was evaluated informally through usability testing conducted by project developers and several test users. Participants reported that the interface was easy to understand and that the process of creating and logging workouts was straightforward. The option to either manually create workout routines or generate them using the AI-assisted workout planner provided flexibility for users with different levels of fitness experience. In particular, the AI workout generator helped reduce the complexity of designing structured workout routines for beginners.

When compared with existing fitness applications, DUM-BEL provides a simplified alternative that focuses on individual workout tracking rather than gym management or subscription-based coaching platforms. Many commercial applications require paid subscriptions for advanced features such as workout planning or analytics. In contrast, DUM-BEL provides core functionality, including workout logging and AI-assisted plan generation, within a lightweight and user-focused design.

Despite these strengths, several limitations remain. The AI workout generator currently relies on predefined logic and user input rather than fully adaptive machine learning models. Additionally, the system has primarily been tested with a limited number of users, meaning large-scale performance and usability testing have not yet been conducted. These limitations present opportunities for future improvements and further development of the system.

5 Challenges and Lessons Learned

One challenge involved designing the system to remain simple and intuitive while still supporting meaningful workout tracking features. Balancing functionality with usability required multiple iterations of the user interface and adjustments to the underlying data structure. Early versions of the application included more complex input forms, which were simplified after usability testing revealed that users preferred a more streamlined workout logging experience.

Another challenge arose during the integration of authentication and real-time database updates through Supabase. Implementing secure authentication required careful handling of asynchronous processes, session management, and database access permissions. Ensuring that users could securely access only their own workout data required configuring row-level security policies within the PostgreSQL database.

Deployment also presented several technical challenges. Configuring environment variables, managing API keys, and maintaining stable communication between frontend and backend services required careful setup and testing. Ensuring that the application functioned consistently across different environments was an important step in preparing the system for deployment.

Through this development process, several important lessons were learned. The project emphasized the importance of modular development practices, continuous testing, and designing with the end user in mind. A key lesson learned was that personal productivity applications must prioritize clarity and ease of use as much as technical capability. Even technically sophisticated systems can fail to meet user needs if the interface is overly complicated to navigate.

6 CONCLUSION

The DUM-BEL application successfully demonstrated the design and implementation of a full-stack mobile application for personal workout tracking and fitness management. The system enables individuals to independently record exercises, monitor workout progress, and maintain organized fitness data through a secure and responsive platform.

By applying modern mobile development practices and cloud-based infrastructure, the project illustrates how a scalable and user-centered application can support personal health goals without reliance on commercial gym management systems. The integration of manual workout creation and AI-assisted workout plan generation provides flexibility for users with varying levels of fitness experience.

Overall, DUM-BEL establishes a foundation for further development of personalized fitness technologies. The system highlights how modern mobile frameworks, cloud databases, and artificial intelligence tools can be combined to create practical and accessible solutions for personal fitness management.

Future Work

Although the current implementation of DUM-BEL provides core workout tracking and planning functionality, several opportunities exist for future expansion and improvement. One potential area of development involves extending the platform to include additional native mobile features such as improved offline capabilities and deeper integration with mobile hardware sensors.

Another area for future work involves enhancing the AI-assisted workout generator. Future versions of the system could incorporate more advanced machine learning models capable of adapting workout plans based on historical user data, workout performance, and long-term fitness goals. This would allow the system to provide more personalized and adaptive exercise recommendations.

Scalability improvements also represent an important future development area. As the number of users increases, optimizing database queries and backend services will become necessary to maintain consistent performance. Additional caching mechanisms and distributed backend services could be implemented to support larger user bases.

Finally, integration with third-party fitness platforms and wearable devices could further expand the system's capabilities. Connecting the application with fitness trackers or health monitoring devices would allow the system to automatically collect workout metrics such as heart rate, burning calories, and activity duration. This integration could provide users with deeper insights into their fitness progress and overall health trends.

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