**Technical Protocol: Sports Exercise Battle (SEB)**

**Project Overview**

The Sports Exercise Battle (SEB) is an HTTP/REST-based server application designed to track push-ups. The system enables users to compete against each other in 2-minute push-up tournaments, with automatic ELO rating adjustments based on performance. This protocol documents the technical implementation, challenges faced and solutions applied during development.

**System Architecture**

The application follows a layered architecture:

1. **Server Layer**: Manages HTTP connections and request routing
2. **Controller Layer**: Contains business logic for user, profile, and tournament operations
3. **Repository Layer**: Handles data persistence and database operations
4. **Model Layer**: Defines data structures for system entities
5. **Database Layer**: Provides connection management to PostgreSQL

**Core Functionality**

**User Management**

* Secure registration and authentication using token-based security
* Editable user profiles with customizable display name, bio, and image
* Password handling with salt-based hashing for security

**Tournament System**

* Automatic 2-minute tournaments triggered by push-up submissions
* Real-time participant tracking with push-up count aggregation
* ELO rating adjustments: +2 for winners, -1 for losers, +1 for ties
* Comprehensive tournament logs for historical reference

**Push-up Tracking**

* Recording of individual push-up sessions with count and duration
* Historical view of all push-up activities
* Statistical analysis of performance (total, average, maximum)

**Unique Feature: Streak System**

* Tracks consecutive days of user activity
* Rewards consistent participation with achievement recognition
* Provides motivational feedback for maintaining exercise habits

**Technical Challenges and Solutions**

**Challenge 1: Token Authentication**

**Problem**: Initial implementation created duplicate tokens during user login, causing database constraint violations.  
**Solution**: Modified the token management system to replace existing tokens for users, ensuring database integrity while maintaining security.

**Challenge 2: Tournament Timing**

**Problem**: Determining when tournaments expire required precise timing management.  
**Solution**: Implemented a timestamp-based approach that checks tournament expiration on every interaction, completing tournaments automatically when their 2-minute window expires.

**Challenge 3: Endpoint Compatibility**

**Problem**: Initial endpoint design didn't match curl script requirements for testing.  
**Solution**: Adjusted endpoint paths and response formats to align with test expectations without compromising architectural integrity.

**Unit Testing Strategy**

The testing approach focuses on critical system components:

1. **Security Components**: Password hashing, token validation (high security impact)
2. **Core Business Logic**: Tournament expiration, ELO calculation (functionality impact)
3. **Data Integrity**: User profile management, push-up recording (reliability impact)

Integration tests validate complete workflows through the system, such as:

* User registration and authentication flow
* Tournament participation and completion
* Push-up recording and history tracking

**Development Metrics**

| **Task Category** | **Time Investment** |
| --- | --- |
| Architecture and setup | 8 hours |
| Core functionality | 15 hours |
| Unique feature implementation | 4 hours |
| Testing and refinement | 9 hours |
| Documentation | 2 hours |
| **Total** | **38 hours** |

**Conclusion**

The Sports Exercise Battle system successfully implements a competitive platform for tracking push-up exercises. The application balances security, performance, and user experience while meeting all specified requirements. The project demonstrates effective use of layered architecture and database design principles, providing a good foundation for future enhancements.

GitHub Link: https://github.com/floerychristopher/sports-exercise-battle