Software Requirements Specification (SRS)

Advanced Tic Tac Toe Game

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1. Introduction

1.1 Purpose

This Software Requirements Specification (SRS) defines the comprehensive requirements for an Advanced Tic Tac Toe Game that incorporates modern software engineering practices including user authentication, personalized game history, intelligent AI opponent, and performance monitoring. This document serves as the primary reference for all stakeholders involved in the development, testing, and deployment of the system.

1.2 Scope

The Advanced Tic Tac Toe Game will provide:
- Interactive 3x3 grid gameplay with intuitive user interface
- Secure user authentication system with password hashing
- AI opponent using minimax algorithm with alpha-beta pruning
- Personalized game history and replay functionality
- Performance monitoring and optimization metrics
- Cross-platform GUI using Qt framework
- Database integration using SQLite for data persistence

2. Overall Description

2.1 Product Perspective

The Advanced Tic Tac Toe Game is a standalone desktop application that enhances the classic game with modern software engineering practices. The system integrates game logic, AI-based decision-making, user management, persistent storage, and a performance tracker into a Qt-based graphical interface.

2.2 Game Features

- User registration and login
- Player vs Player (PvP) and Player vs AI (PvAI) modes
- AI decision-making using the Minimax algorithm
- Game recording and history tracking
- Replay of past games
- Performance monitoring and metrics logging
- Data persistence through SQLite database

2.3 User Characteristics

- Primary Users: General users with basic computer skills
- No programming knowledge required
- Accessible via desktop environments on Windows, Linux, or macOS

2.4 Constraints

- Must be developed in C++ using the Qt framework
- SQLite must be used for local data storage
- Follows object-oriented programming principles

2.5 Assumptions and Dependencies

- Qt libraries are available on target systems
- No internet connection is required for core features
- No simultaneous multi-user support required

3. Specific Requirements

3.1 Functional Requirements

- User registration with username and password
- Login authentication with password hashing (SHA-256)
- Game board management with 3x3 clickable cells
- Alternating turns between players (PvP) or between player and AI (PvAI)
- AI decision-making using minimax
- Game rule enforcement (win, draw, move validation)
- Game data storage including mode, winner, and move history
- Replay system with animation controls
- Performance tracking (login time, AI decision time, game duration)

3.2 Non-Functional Requirements

- Login operations complete in < 500ms
- AI move execution within 2 seconds
- Data protection via secure hashing and input validation
- Reliable error handling with user-friendly messages

4. External Interface Requirements

4.1 User Interfaces

- Qt-based GUI with login/registration forms
- Game board with clear indicators and visual feedback
- Buttons for replay, PvP, and PvAI selection
- History viewer and replay interface

4.2 Hardware Interfaces

Standard desktop or laptop system with mouse and keyboard input.

4.3 Software Interfaces

Interacts with SQLite for database storage and Qt for GUI rendering.

5. Quality Attributes and Constraints

- Usability: Intuitive design suitable for novice users
- Maintainability: Code modular and well-documented
- Portability: Compatible with Windows, Linux, and macOS
- Security: Passwords hashed and no sensitive data stored in plain text