System design specification

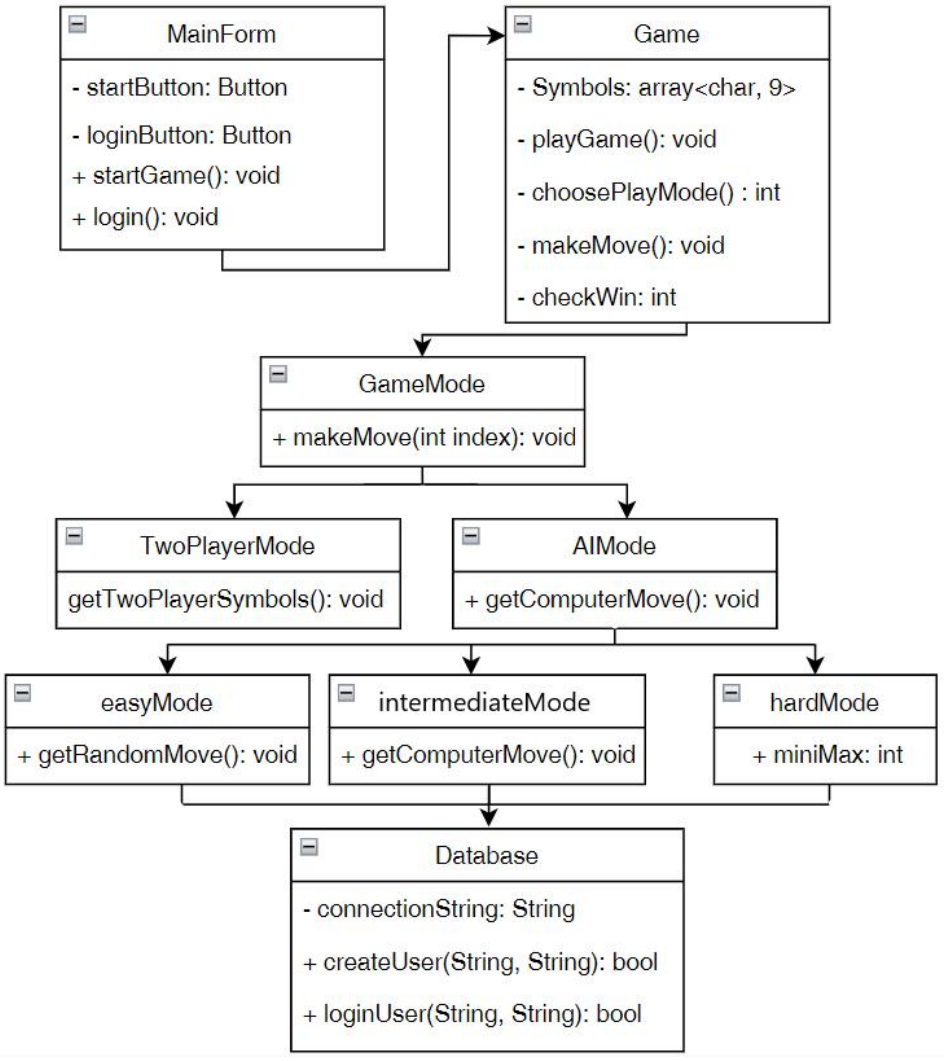
1. Software Architecture

High-Level Architecture

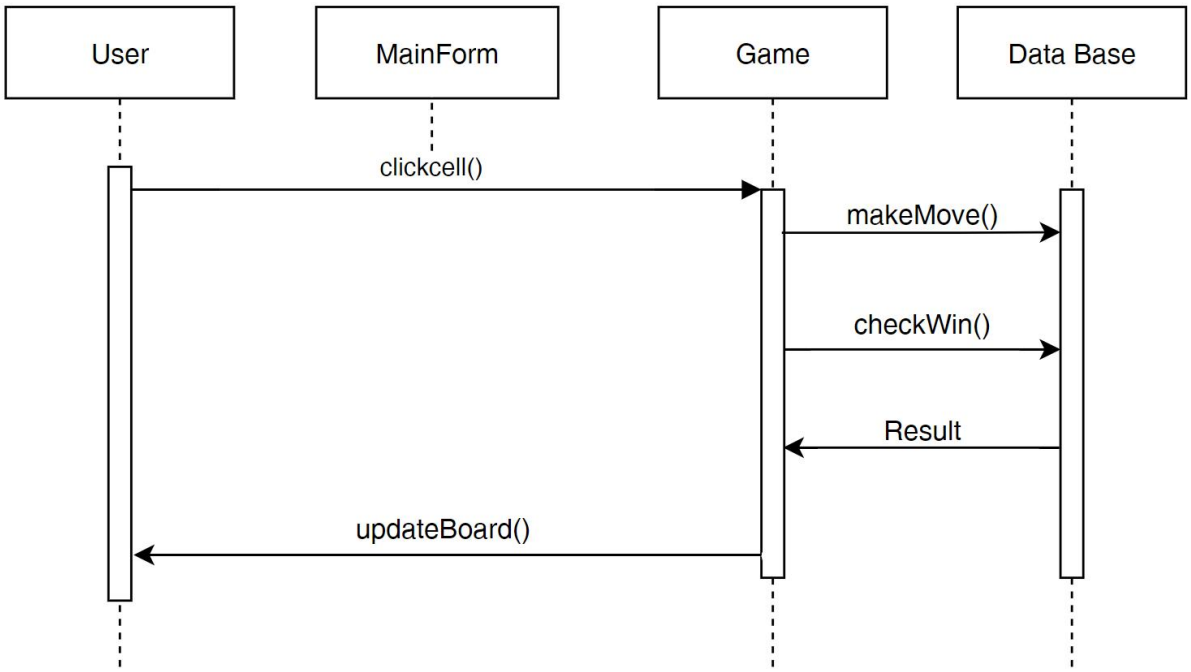
- **User Interface (UI):** Manages user interactions and displays the game board using Windows Forms.
- **Game Logic:** Handles the core game functionality, including move validation, win/draw detection, and turn management.
- **Database:** Stores user data, game records, and handles login/sign-up functionality.
- **AI Component:** Manages the AI opponent logic and its moves.

2. Detailed Design

2.1. Class Diagrams



2.2. Sequence Diagram



3. Detailed Component Design

3.1. User Interface (UI)

The UI component manages all user interactions and displays the game board.

MainWindow Class:

Attributes:

- Start Button: Button: Button to start a new game.
- Sign up Button: Button: Button to open the sign up dialog.

Methods:

- startGame(): Initializes a new game.
- sign up(): Opens the sign up dialog.

3.2. Game Logic

The game logic component handles all the core functionality of the Tic Tac Toe game.

Game Class:

Attributes:

- symbols: array of char: The 3x3 game board.

Methods:

- makeMove(int index): Makes a move on the board, getTwoPlayersSymbols() for two players mode and minimax() for AI opponent mode.

- checkWin(): Checks if there is a winner.

- aiMove(): Executes the AI opponent's move, getRandomMove() for easy mode, getComputerMove() for intermediate mode and minimax() for impossible mode.

3.3. Database

The database component manages user data and game scores for the two modes.

Database Class:

Attributes:

- db: Represents the SQLite database connection managed by QSqlDatabase.

Methods:

- Database(): Constructor initializes the SQLite database connection using QSQLITE driver and sets the database file name.

- createUser(const QString& username, const QString& password): Inserts a new user record into the Users table with provided username and password.

- loginUser(const QString& username, const QString& password): Queries the Users table to check if a user with the provided username and password exists.

3.4. AI Component

The AI component manages the logic for the AI opponent.

AI Class:

- Methods:

  - int miniMax(char symbols[][3], bool isMaximizing, bool firstTime, int alpha, int beta): Calculates the AI's next move based on the current board state.