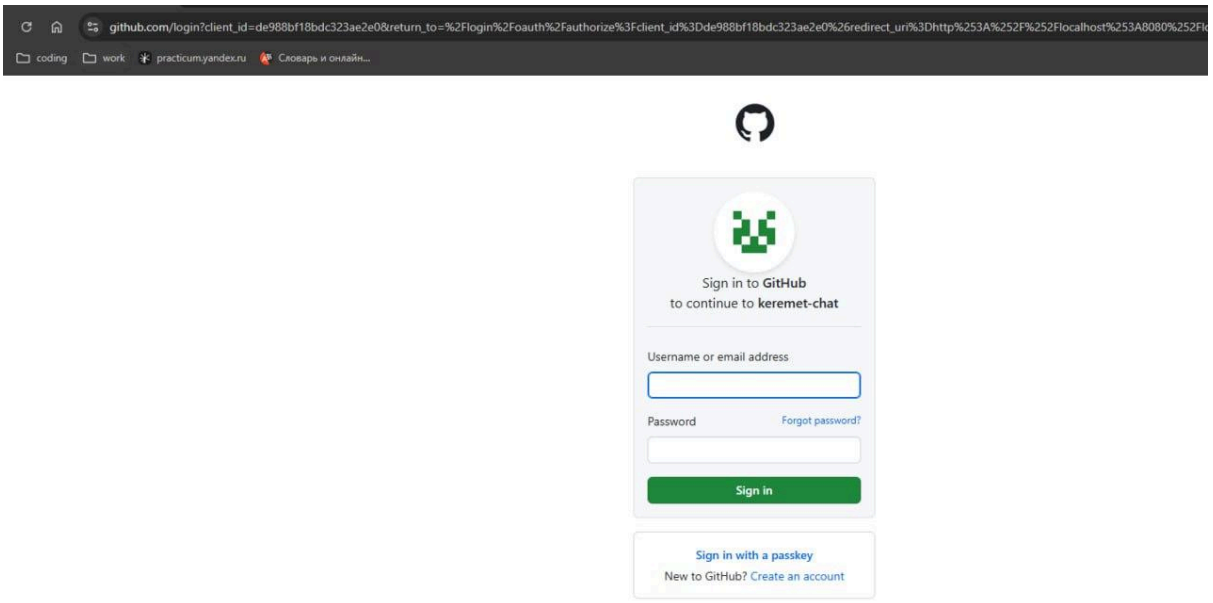
Final Project Report: Tic-Tac-Toe Game

1. Introduction

Our final project is an **online multiplayer Tic-Tac-Toe game**, allowing players to sign in via **GitHub authentication**, play against friends or online opponents, and track their stats. The game offers customizable board themes, different figure styles, and settings for sound and dark mode. The project was developed using **modern web technologies** and deployed on **[platform]**.

2. GitHub Authentication System



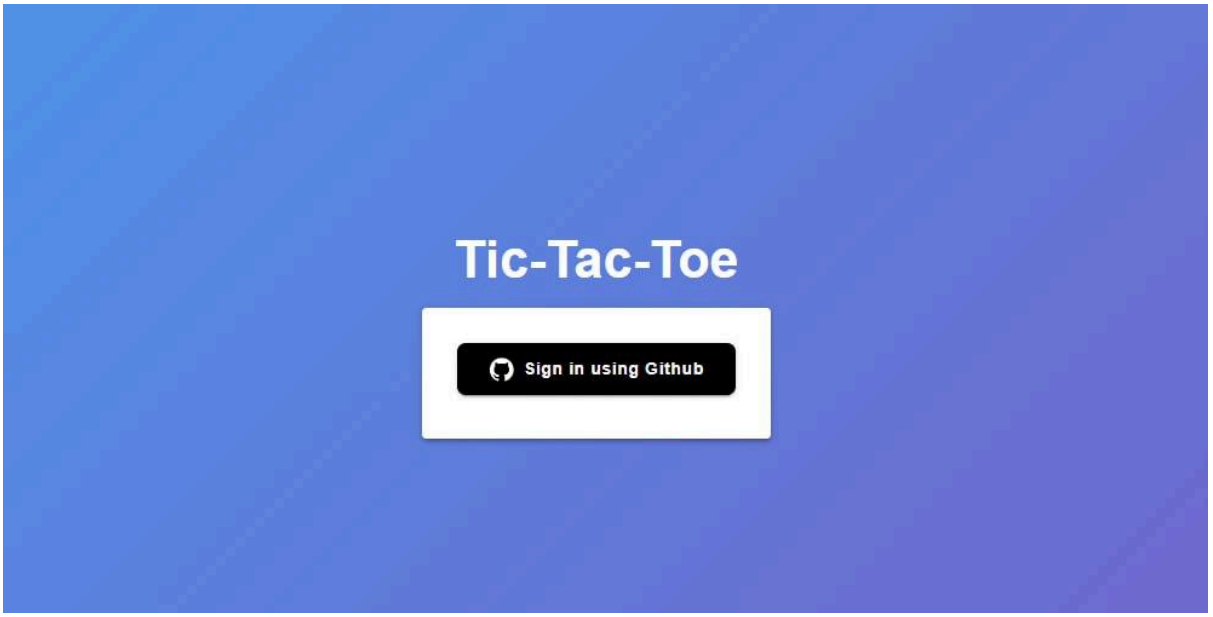
GitHub Login Page

- Players are required to **log in using their GitHub accounts**.
- This provides a **secure and streamlined** authentication system.
- Once authenticated, users gain access to **online multiplayer, personalized profiles, and game statistics**.

Implementation Details:

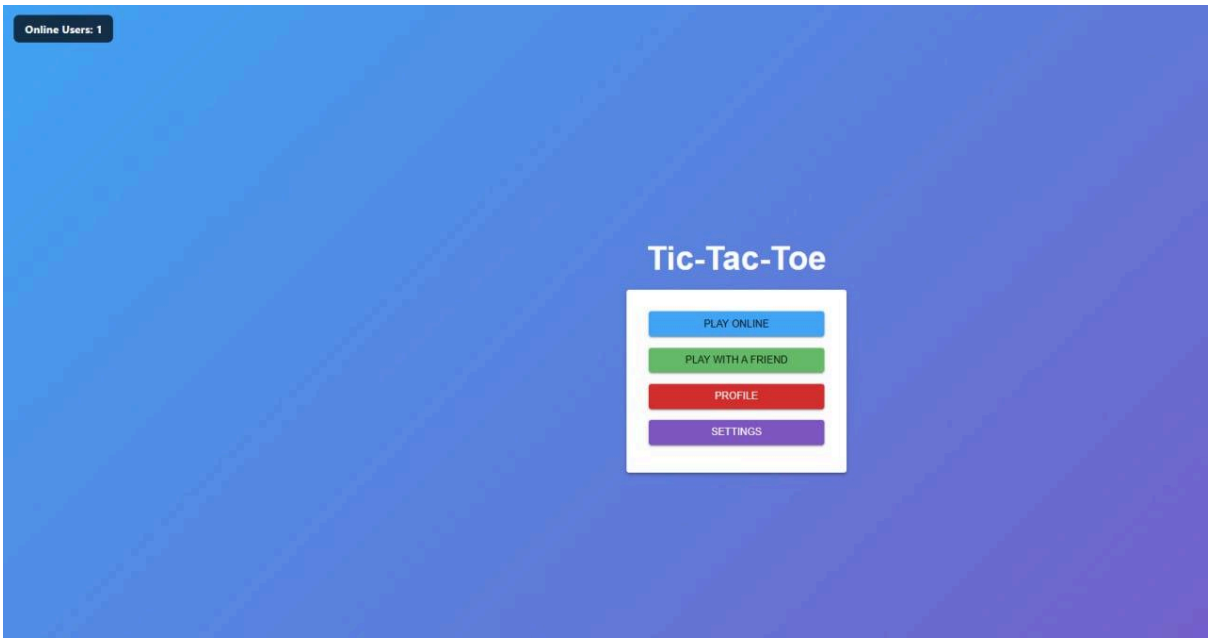
- OAuth authentication is set up using **GitHub API**.
- The system securely handles **user sessions and data**.
- After logging in, the user is redirected to the game interface.

3. Game Main Menu



Game Start Screen (GitHub Sign-In)

- The **main landing page** welcomes the player.
- A **"Sign in using GitHub" button** is prominently displayed.
- Without signing in, the player **cannot access online features**.



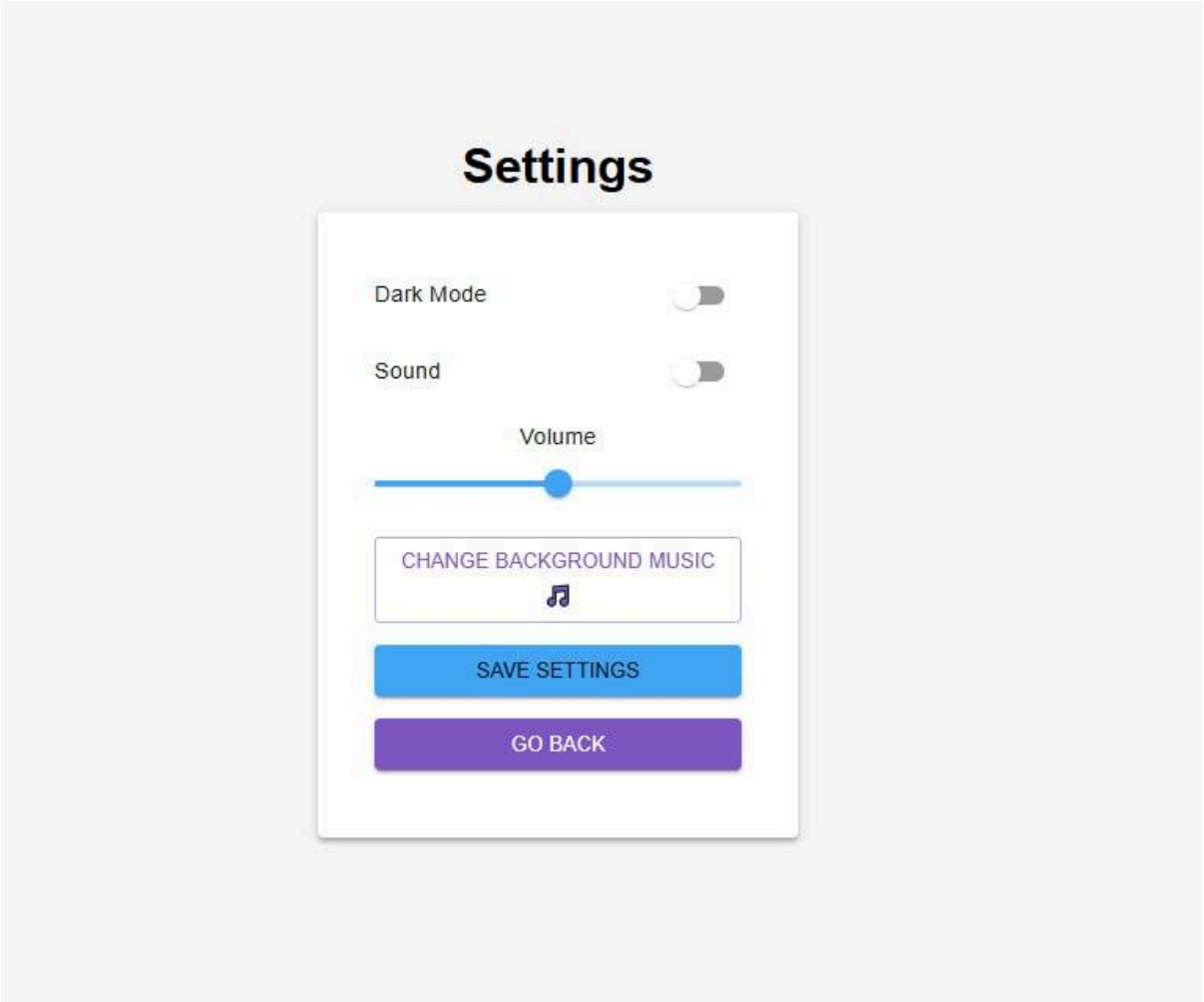
Main Menu

- Once logged in, the **main menu** appears with the following options:
  ✅ **Play Online** – Connects to the online matchmaking system.
  ✅ **Play with a Friend** – Local multiplayer mode.
  ✅ **Profile** – View player statistics and achievements.
  ✅ **Settings** – Customize game preferences (sound, dark mode, themes).

Implementation Details:

- The UI is built using **React with Tailwind CSS**.
- The main menu dynamically updates based on the **player's authentication status**.
- **WebSockets** handle online matchmaking and real-time communication.

4. Settings Page



Settings Panel

- Allows players to customize their experience:
  Dark Mode Toggle – Enables/disables dark theme.
  Sound Toggle – Turns game sound effects on/off.
  Volume Slider – Adjusts game audio level.
  Change Background Music – Selects different background tracks.

Implementation Details:

- Uses **local storage** to save settings persistently.
- Background music is managed using **HTML5 Audio API**.
- The settings page dynamically updates the UI based on user preferences.

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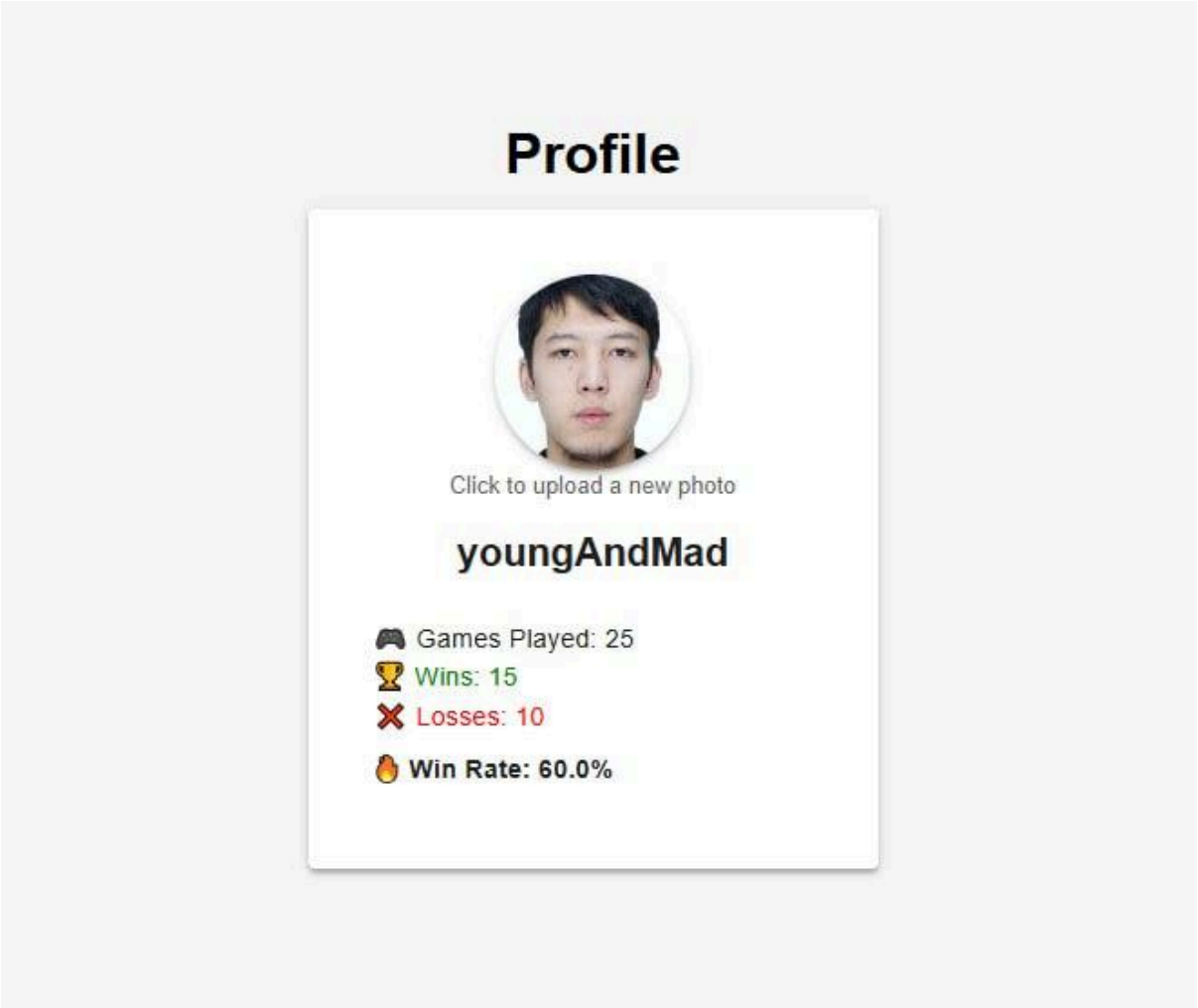
5. Player Profile Page



User Profile

- Displays personalized **player statistics**:

  Username and Profile Picture (retrieved from GitHub).
  Total Games Played.
  Wins & Losses count.
  Win Rate % (calculated dynamically).

Implementation Details:

- Player data is stored in a **NoSQL database (Firebase/MongoDB)**.
- Uses **GitHub API** to fetch and display **avatars & usernames**.
- Statistics update in real-time after each match.

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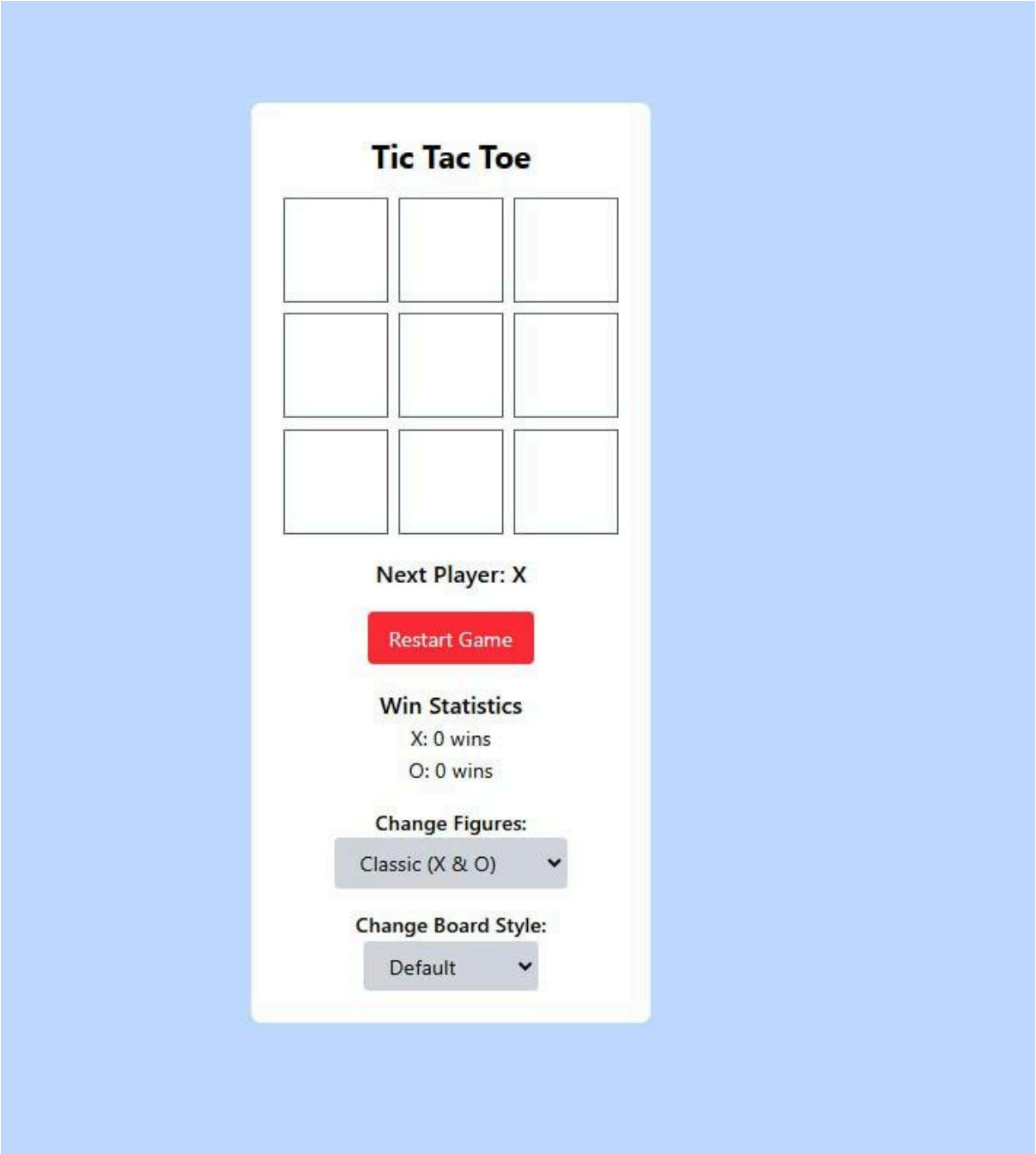
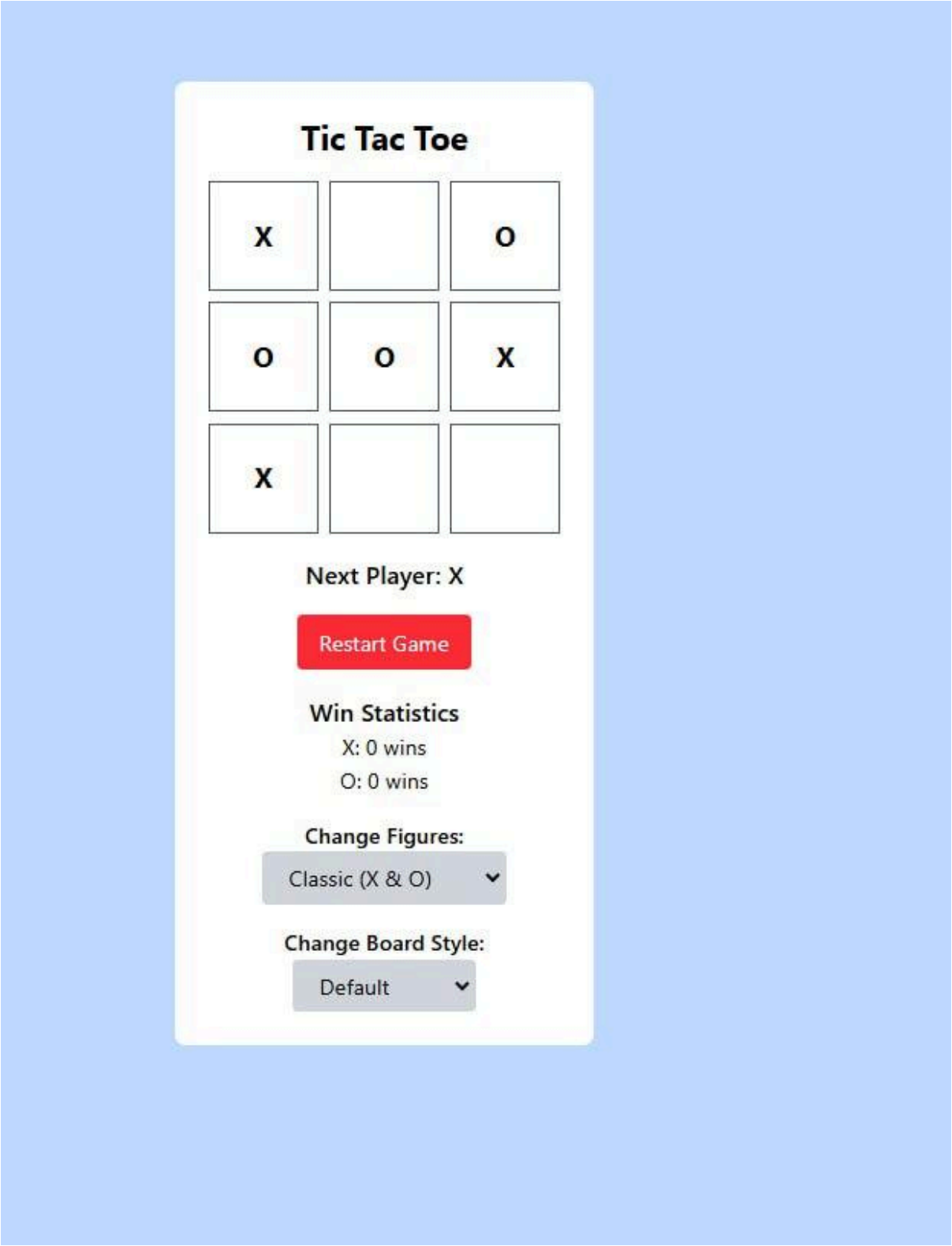
6. Core Gameplay - Tic-Tac-Toe Board



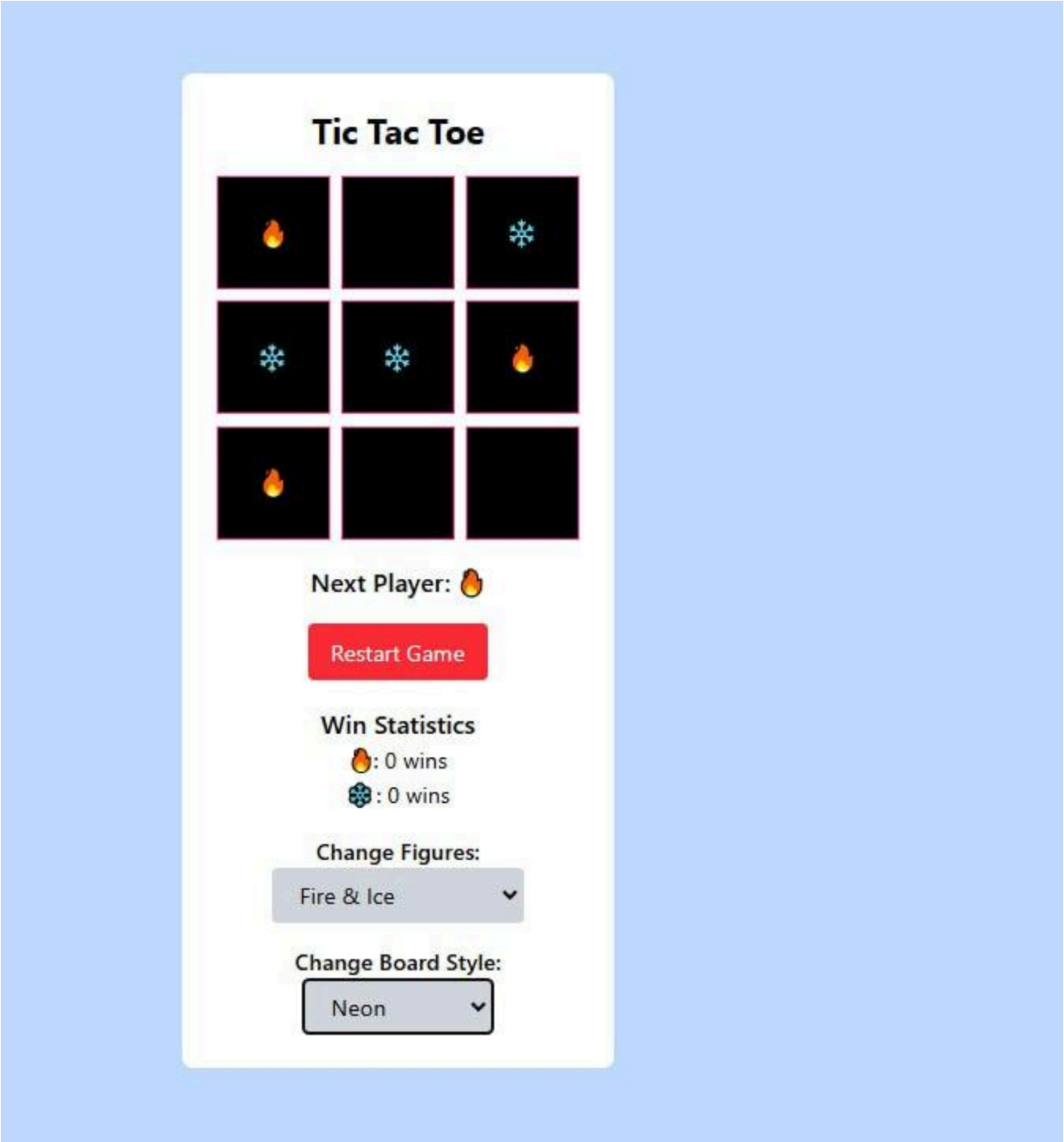
Game Board (Empty State)

- The game begins with an **empty 3x3 grid**.
- The **current player** is displayed at the bottom.
- **Restart Game** button allows resetting the match.
- **Win Statistics** show player performance.



Game in Progress

- Players take turns placing **X or O** on the board.
- The next player's turn is dynamically updated.



Customizable Themes & Figures

- Players can switch between:
  Classic X & O.
  Fire & Ice theme with animated visuals.
  Neon Board Style for a futuristic feel.

Implementation Details:

- Uses **React for dynamic updates** without page reloads.
- Board state is managed via **Redux**.
- **Animations & themes** are handled using **CSS & SVG sprites**.

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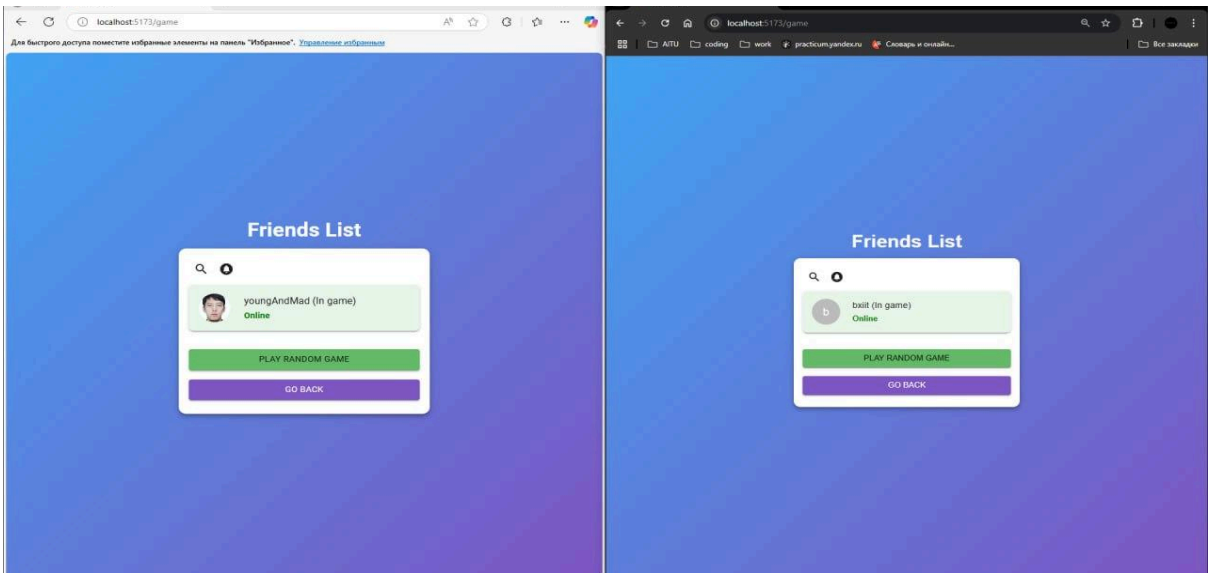
7. Online Multiplayer Gameplay



Multiplayer Match in Progress

- Players can compete **in real-time** using the **WebSocket protocol**.
- The match updates **synchronously** between different devices.
- The winner is **highlighted**, and the board resets after the match.

Implementation Details:

- **WebSockets (Socket.io)** enable real-time multiplayer.
- The server **manages matchmaking** and synchronizes player moves.
- Each move is validated to prevent cheating.

8. Conclusion & Future Improvements (Detailed Version)

Project Success & Achievements

The **Tic-Tac-Toe project** was designed to deliver an engaging multiplayer experience with **secure authentication, real-time gameplay, and user customization**. The key achievements of this project include:

Secure GitHub Authentication for User Accounts

- The game seamlessly integrates **GitHub OAuth authentication**, allowing players to log in using their GitHub credentials.
- This provides a **secure, convenient, and fast** way for players to access the game, eliminating the need for additional credentials.
- Once logged in, users can access **online multiplayer features**, track their **personal game statistics**, and manage their **profile settings**.

Customizable UI with Themes and Settings

- The game includes a **settings panel** where players can **toggle Dark Mode**, **adjust volume**, and **change background music**.
- Different board styles and figure sets provide **aesthetic customization**, allowing players to personalize their gaming experience.
- The **Fire & Ice theme** and **Neon board style** introduce a more engaging **visual appeal** compared to the traditional Tic-Tac-Toe design.

Real-Time Online Multiplayer using WebSockets

- The game implements **WebSocket-based** real-time multiplayer, enabling two players to compete **synchronously** over the internet.
- Moves are transmitted instantly between connected players, ensuring **a smooth and competitive experience**.
- A match-tracking system ensures that each game is fair, and no duplicate moves can be made.

Personalized Player Profiles and Statistics Tracking

- The **profile page** provides an overview of each player's performance, including:
  - **Number of games played**
  - **Wins & losses**
  - **Win rate percentage**
- Player usernames and avatars are automatically fetched from **GitHub**, enhancing personalization.

Planned Enhancements & Future Improvements

To improve the overall **game experience and engagement**, we have identified several key enhancements for future updates:

1 ELO Rating System for Ranked Matchmaking

- A ranking system based on the **ELO algorithm** will be introduced to **match players of similar skill levels**.
- Players will **gain or lose points** after each match, creating a **competitive environment** similar to chess or online multiplayer games.
- This will help **balance matches** and improve engagement by pairing players with **similar experience levels**.

2 AI Opponent for Single-Player Mode

- Currently, the game only supports **multiplayer gameplay**, but we plan to develop an **AI opponent** for players who want to practice alone.
- The AI will have **multiple difficulty levels**, ranging from **beginner to expert**.
- The implementation will use **Minimax Algorithm** to create a **challenging** and **strategic** opponent.

3 Global Leaderboard for Top-Ranked Players

- A **leaderboard system** will be introduced to display:
    - **Top-ranked players** based on win percentage.
    - **ELO rating scores** for competitive ranking.
    - **Streak-based achievements** (e.g., highest consecutive wins).
- This feature will **encourage competitive play** and give players a **goal to strive for**.

4 Expanded Thematic Skins & Animations

- More **board styles, themes, and animated effects** will be added to make the game visually appealing.
- Planned additions include:
    - **Sci-fi & Cyberpunk themes**
    - **Animated X & O symbols**
    - **Dynamic background effects**
- These improvements aim to **enhance the user experience** and make the game feel **more modern and engaging**.

Final Thoughts

The **Tic-Tac-Toe project** successfully combines **classic gameplay with modern web technologies**, bringing an **interactive** and **customizable** experience to players. The planned enhancements will further improve the **gameplay depth, competitiveness, and personalization**. We are excited to continue refining the game and adding **new features** to make it even more **immersive and fun** for users.