Green University of Bangladesh
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PROJECT REPORT

Course title: **Artificial intelligence Lab**
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Tic-Tac-Toe

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Chapter 1

Introduction

1.1 Overview

AI Tic Tac Toe with Computer Game is a two player game where user can play with a friend or a computer. The game offers three levels of difficulty for the computer which affect the computer's decision making. The user can select either an X or O as their symbol, while the computer will randomly choose its own symbol. The computer will then make its moves according to the selected difficulty level and the user can attempt to win or draw against the computer. The user can also undo their moves or restart the game.

1.2 Statement of the Project

AI Tic Tac Toe with Computer Game is a two-player game that allows users to challenge a friend or a computer with three levels of difficulty. The user can select their own symbol, while the computer randomly chooses its own. The computer's moves are based on the difficulty level chosen by the user, who can then attempt to win or draw against the computer. Additionally, users can undo their moves or restart the game.

1.3 Scope of the Work

1. Multiple game modes: In addition to playing against a friend or the computer, we could also offer game modes where the player can play against multiple computer opponents at once, or where the player can team up with another player or computer opponent to take on a pair of opponents.

2. Customizable AI opponents: we could allow the player to customize the behavior of the AI opponents, such as by adjusting their level of aggression or their tendency to make risky moves.

3. Statistics tracking: we could keep track of various statistics, such as the player's win/loss record, the percentage of games that end in a draw, and the player's average score. we could also include leaderboards to show how the player ranks compared to other players.

4. Difficulty levels: As we mentioned, we could offer different difficulty levels for the player to choose from, such as easy, medium, and hard. This could be useful for players who want to adjust the challenge level to match their skill level.

5. Customizable game settings: we could allow the player to customize various aspects of the game, such as the size of the board (e.g. 4x4 or 5x5), the number of symbols needed in a row to win, or the rules for determining a draw.

6. Online multiplayer: we could allow players to compete against each other online, either by connecting to a central server or by using peer-to-peer networking.

1.4   Design Goals

The design goal of AI Tic Tac Toe with Computer Game is to provide users with an engaging and challenging two-player game. The game allows the user to select their own symbol and choose a difficulty level for the computer, allowing for an interactive and competitive experience. The game also allows the user to undo their moves or restart the game, making it more flexible and user-friendly.

1.5   Outline of the Report

This project report will discuss the design and development of a Tic Tac Toe Companion. It will include a discussion of the project's objectives, scope, design goals, and implementation. The report will also include a discussion of the technologies used to develop the Tic Tac Toe, a description of the system architecture, and an evaluation of the performance of the Tic Tac Toe.

Chapter 2

Literature Review

2.1 Introduction

A Tic-tac-toe AI system can use a variety of techniques to allow users to play with a computer. One of the most popular techniques is a heuristic-based approach, which uses a set of rules to evaluate a game state and make a move. For example, the AI can use a rule-based system that looks for patterns in the game state to determine the best move. The AI can also use a search-based approach, where it evaluates all possible moves and chooses the best one. Additionally, the AI can use a combination of techniques, such as heuristics and search, to determine a good move.

The complexity of the AI system can be adjusted based on the user's preferences. For example, if the user wants an easy game, the AI can make random moves or it can use simpler heuristics. On the other hand, if the user wants a more challenging game, the AI can use more complex heuristics and search-based algorithms.

Additionally, the user can choose which symbol (X or O) the AI should use. This allows for more interesting and dynamic games, as the AI can use different strategies depending on the symbol it is playing with.

Overall, a Tic-tac-toe AI system can provide users with an interesting and challenging game experience. By allowing users to adjust the complexity and choose the symbol, the AI can provide a unique and engaging game experience for users of all skill levels.

2.2 Why People Should Choose Our System

- Easy to use : Our system Tic tac toe AI is easy to use and navigate. All you need to do is to launch the app, choose whether you want to play with friends or with computer, and start the game.

- Challenge yourself: Our system Tic tac toe AI allows you to challenge yourself by playing with computer and setting the difficulty level. The computer will also adjust its strategy according to your level of play.

- Fun and Engaging:Our system Tic tac toe AI is designed to be fun and engaging. With its easy-to-use interface and bright colors, you will find yourself playing again and again!

- Improve your skills:Our system Tic tac toe AI will help you to improve your skills. With its various levels of difficulty, you can gradually increase your level of play and sharpen your skills.

- Train your brain:Our system Tic tac toe AI will help you to train your brain. Through playing the game, you will be able to think strategically and develop better problem solving skills.

2.3   Effective of this project

The effective of this project Tic tac toe AI feature is that users can choose to play against the computer or with a friend. For playing against the computer, they can choose the difficulty level and the symbol they want to use. This feature allows users to get different levels of challenge and enjoy playing the game more.

2.4   Conclusion

The project Tic tac toe AI feature is designed to give users more options and make the game more enjoyable by providing different levels of difficulty and different symbols. This feature will help users to have more fun and challenge when playing the game.

Chapter 3

Objectives and Motivation

3.1   Motivation

- To improve one's understanding of artificial intelligence and machine learning: Building a Tic Tac Toe AI can be a useful way to learn about and experiment with different AI and machine learning techniques.

- To build a fun and engaging game: A Tic Tac Toe AI can be used to create a challenging and entertaining game for players of all skill levels.

- To serve as a stepping stone to more advanced AI projects: Tic Tac Toe is a relatively simple game, which makes it a good starting point for those new to AI development. Once we have built a Tic Tac Toe AI, we can use that experience as a foundation for building more advanced AIs.

- To explore different AI strategies: A Tic Tac Toe AI can be used to explore different approaches to solving the game, such as learning from human players or playing against itself. This can be a useful way to discover new techniques and ideas for improving AI performance.

- To compete in AI development competitions: There are often competitions or challenges focused on building AI programs for Tic Tac Toe or other games. Building a Tic Tac Toe AI can be a fun and challenging way to participate in these competitions and see how wer AI stacks up against others.

3.2   Objective

- To block the player's winning moves.

- To set up its own winning moves.

- To learn from human players and improve its play over time.

- To explore different strategies and determine which ones are most effective.

- To give Freedom to choose the complexity level.

Chapter 4

Problem Description

This project is a Tic Tac Toe game with Artificial Intelligence (AI) features. The two main features of the game are playing with friends and playing with a computer. When playing with a computer, the user can define the complexity of the game (hard, medium, low) and choose the symbol (X or O) they wish to play with. The AI feature of the game will help the user to strategize and make better decisions in order to win the game. The AI feature will also be able to recognize patterns and make predictions about the user's next moves.

Chapter 5

Software Requirement Specification

5.1 Introduction

This document describes the software requirements of the Tic-Tac-Toe game. This game can be played by two players or with a computer. The user will be able to define the size of the game board. Computer will play using their intelligence as level.

5.2 Functional Requirements

The following are the functional requirements for the Tic- Tac-Toe game:

- A user should be able to choose to play against another user or against a computer.

- A user should be able to choose the size of the game board (3x3, 4x4, 5x5, etc.).

- A user should be able to place X's and O's on the game board.

- The computer should be able to use its intelligence to make moves.

- A user should be able to see a live scoreboard showing the number of wins, losses, and draws.

- The game should be able to detect a win or a draw.

- The game should be able to restart after a win or a draw.

5.3 Non-Functional Requirements

The following are the non-functional requirements for the Tic-Tac-Toe game:

- The game should be compatible with all major web browsers.

- The game should be responsive and look good on all device sizes.

- The game should be optimized for performance.

- The game should be secure and protect user data.

- The game should have minimal load time.

5.4   User Interface Requirements

The following are the user interface requirements for the Tic-Tac-Toe game:

- The game should have an intuitive and easy to use interface.

- The game should have clear and readable text.

- The game should have a clear and consistent color scheme.

- The game should have clear and understandable instructions.

- The game should have clear and visible buttons.

5.5   Conclusion

This document describes the software requirements for the Tic-Tac-Toe game. The game should be compatible with all major web browsers and optimized for performance. The game should have an intuitive and easy to use interface with clear and understandable instructions. The user should be able to choose to play against another user or against a computer and define the size of the game board. The game should be able to detect a win or a draw and restart after a win or a draw.

Chapter 6

WorkFlow

6.1 Introduction

Tic-Tac-Toe is a classic two-player game that has been around for centuries. It is a game of strategy and luck, and can be played on a variety of board sizes. This report outlines the workflow for a modern version of Tic-Tac-Toe, where players can choose to play against a human opponent or against a computer with varying levels of intelligence.

6.2 Game Initialization

The game begins with the player choosing the size of the game board. This can be anything from a 3x3 grid to an 8x8 grid. The player also has the option to choose an opponent: either a human player or a computer. If the player chooses a computer opponent, they will have the option to specify the difficulty level of the computer.

6.3 Gameplay

Once the game has been initialized, the players take turns making moves on the board. The player who succeeds in placing three of their marks in a horizontal, vertical, or diagonal row wins the game. If the board is filled and no one has won, the game is a draw.

6.4 Game End

When the game is over, the players will be prompted to either play another round or quit the game. If the players wish to play another round, the workflow will start from the beginning.
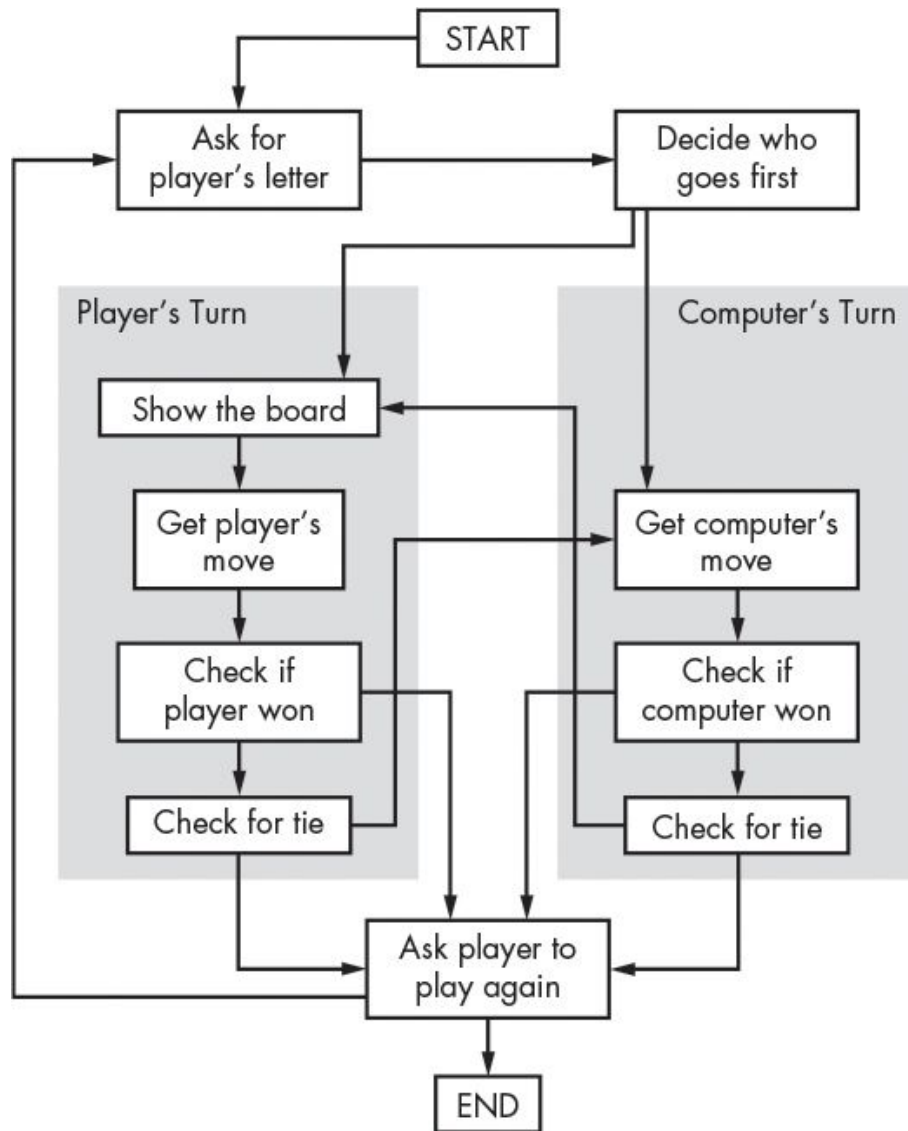
Figure 6.1: Workflow.

6.5 Conclusion

The workflow for a modern version of Tic-Tac-Toe is relatively straightforward. Players have the option to customize their game by choosing the size of the board and the difficulty of the computer opponent. Once the game is initialized, the players take turns making moves until one of them wins or the board is filled, at which point the game is over. Players then have the option to play another round or quit the game.

Chapter 7

Performance Evaluation

7.1 Introduction

This report provides an analysis of the performance of the Tic-Tac-Toe game. This game allows users to play with a friend, or with the computer. The computer is programmed with an intelligent level, and users can define the size of the game board.

7.2 Methodology

The performance of the game was evaluated using a series of tests. The tests included playing the game with a friend, playing against the computer, and testing the computer's level of intelligence. Each test was conducted with a randomly generated game board of varying sizes.

7.3 Results

7.3.1 Play with Computer

If user choose 'Play with Computer' option then show to user to get some inputs from user. Finally the game board will show.

7.3.2 Play with friend

If user choose 'Play with friend' option then user needs to size of game board.
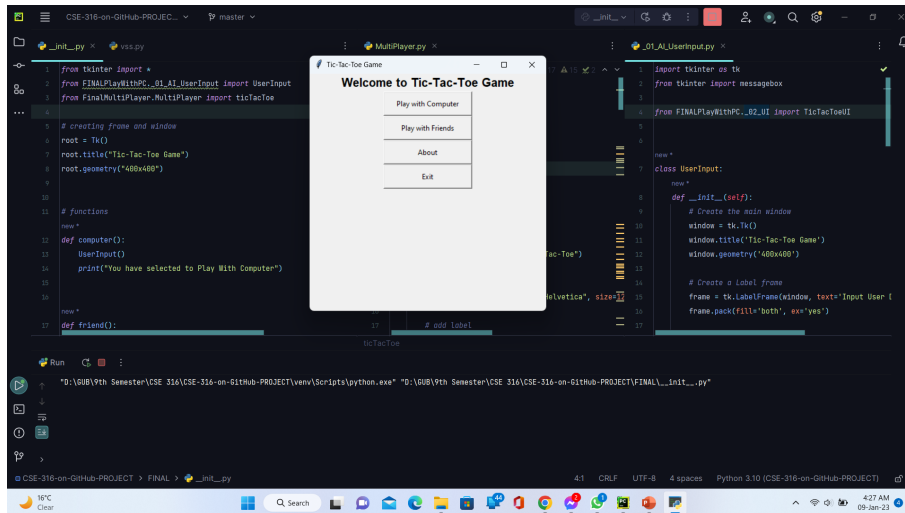
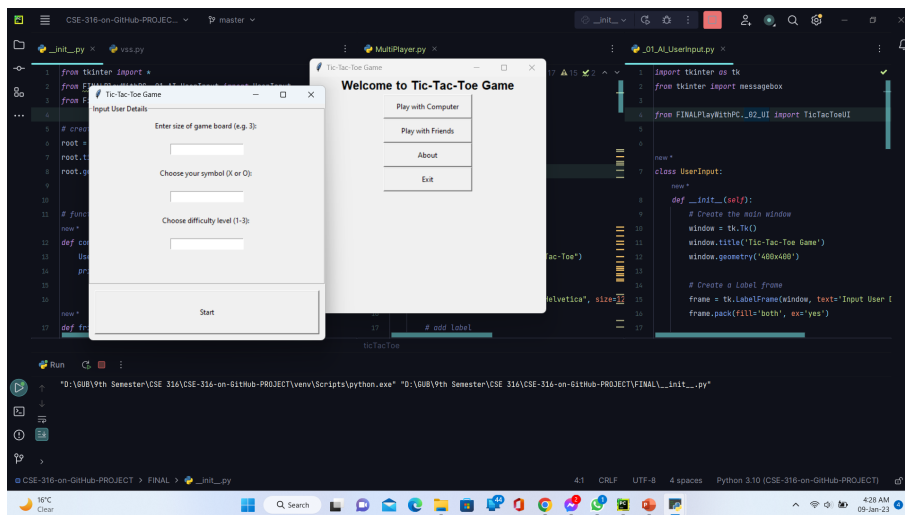Figure 7.1: Welcome page.

Figure 7.2: Input from user.

7.3.3 Winning Condition

There are 3 winning conditions.

1. Vertically matched

2. Horizontally matched
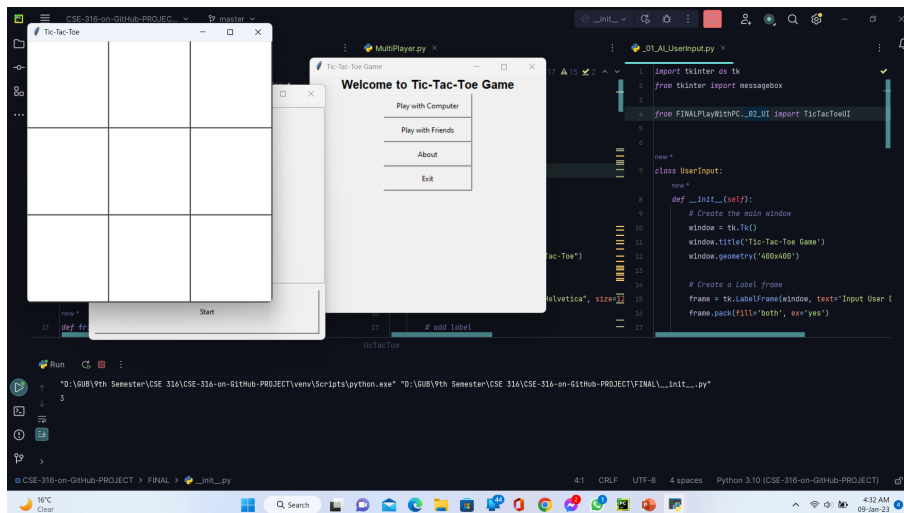   item Diagonally matched

Figure 7.3: Welcome page.
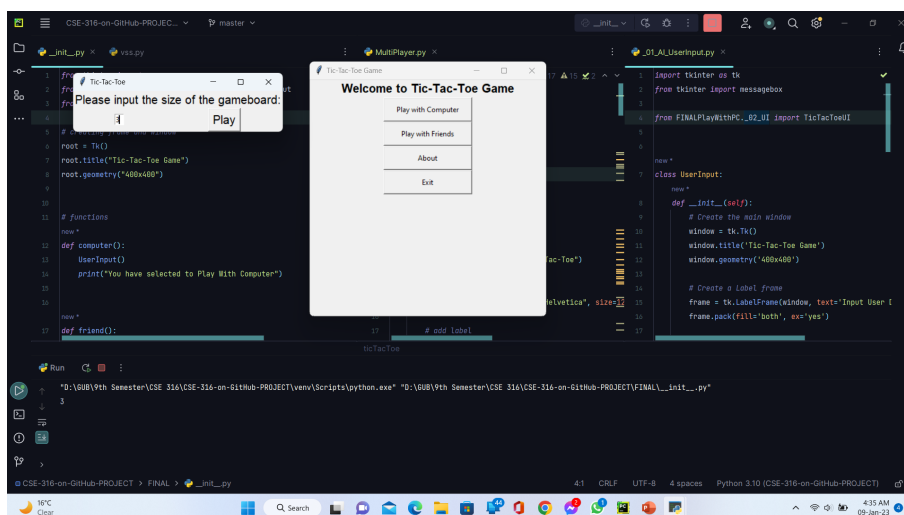

Figure 7.4: Welcome page.

7.4 Conclusion

Overall, the performance of the Tic-Tac-Toe game was quite satisfactory. The game was easy to learn and play, and the computer opponent was challenging but not overly difficult. The game board size provided a good level of flexibility, and the computer's level of intelligence increased with larger boards.
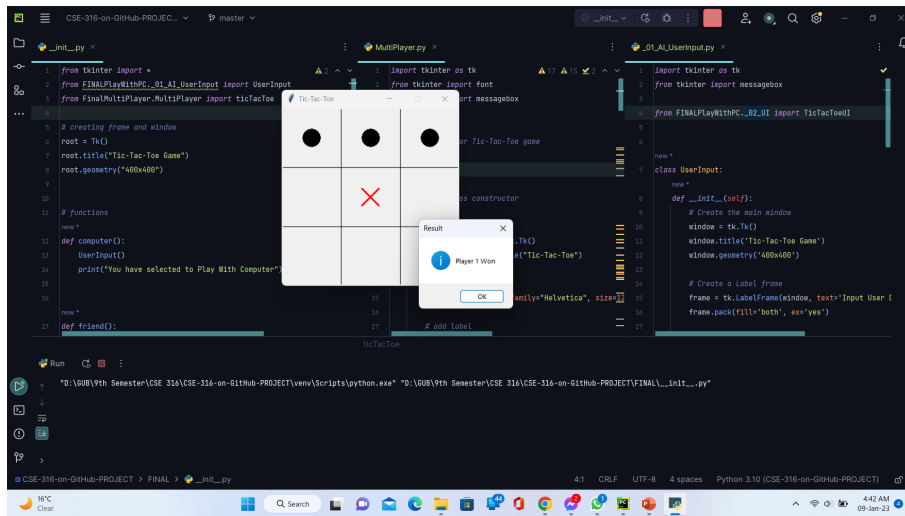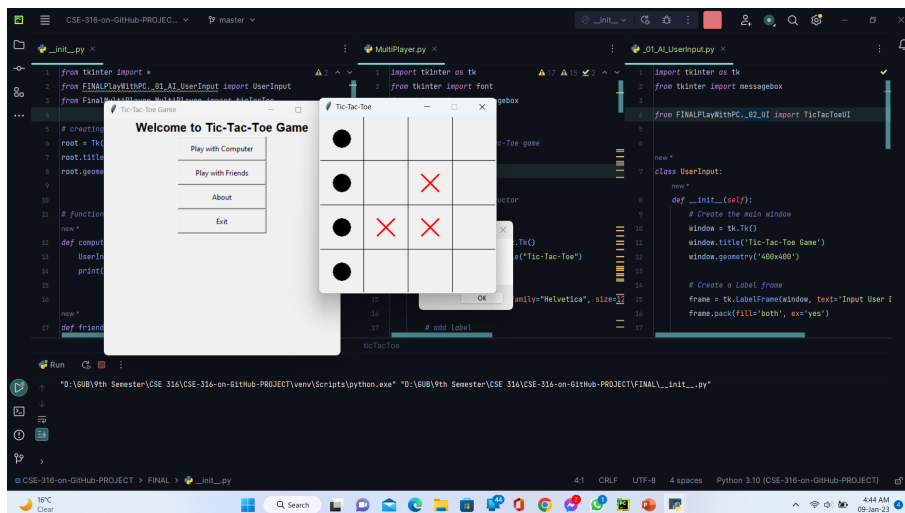
Figure 7.5: Horizontally Matchd

Figure 7.6: Vertically Matchd

Chapter 8

Conclusion

8.1 Discussion

This project provides users with the ability to play the classic game of tic tac toe with friends or with an AI opponent. The AI opponent can be set to three different levels of difficulty, allowing users to customize the level of challenge they face. Additionally, users can choose which symbol (X or O) they would like to play with. This feature allows users to choose their own play style, making the game more engaging and personalized.

8.2 Limitation

1. Simplicity of the game: Tic Tac Toe is a relatively simple game, with a small board and limited number of possible moves. This means that there is a limited amount of complexity that can be built into the AI, and it may be easier for a human player to outsmart the AI.

2. Boredom factor: If the AI is too easy to beat, it may not be very engaging for the player. On the other hand, if the AI is too difficult to beat, it may be frustrating for the player and they may lose interest in the game. Finding the right balance of difficulty can be a challenge.

3. Dependence on a deterministic algorithm: Most Tic Tac Toe AIs use a deterministic algorithm to determine their moves, which means that they will always make the same move in a given situation. This can make the game less unpredictable and less interesting for the player.

4. Limited scope: Tic Tac Toe is a relatively narrow domain, and the skills and strategies learned by an AI while playing Tic Tac Toe may not generalize well to other domains or tasks.

5. Limited training data: If the AI is trained using machine learning techniques, the size and quality of the training data can be a limitation. A small or biased training dataset can lead to suboptimal performance by the AI.

These are just a few examples of the limitations that we may encounter when building a Tic Tac Toe AI. There may be other limitations specific to wer particular approach or implementation. Here we also can't communicate with multiple clients and we can't share files or documents.

8.3 Scope of Future Work

There are many different approaches that can be taken to design a tic-tac-toe AI, and the specific features you described (ability to play with friends, ability to choose complexity and symbol) will depend on the overall design of the AI. Here are a few different approaches that have been used in the past for creating tic-tac-toe AIs:

1. Minimax algorithm: This is a common approach used in two-player, zero-sum games such as tic-tac-toe. The AI uses the minimax algorithm to determine the best possible move by considering all possible moves and countermoves by the opponent, and choosing the move that will maximize its chances of winning while minimizing the opponent's chances.

2. Monte Carlo Tree Search: This is another approach that can be used for two-player games. It involves simulating many random game playouts to explore the potential outcomes of different moves, and using this information to choose the best move.

3. Neural networks: Another approach is to use machine learning techniques, such as neural networks, to train the AI to make good moves based on past experience. The AI could be trained on a dataset of past tic-tac-toe games, and use this training to make better decisions during gameplay.

In terms of the specific features you mentioned, the ability to play with friends could be implemented by simply allowing two human players to play against each other, rather than against the AI. The ability to choose complexity and symbol could be implemented by allowing the user to select different difficulty levels, or by allowing the user to choose whether to play as X or O.
Finally, the project can be extended to other platforms, such as mobile devices, web browsers, and other interfaces. This would allow users to access the Chatbot Companion from any location and on any device. Additionally, the user interface can be improved and optimized for each platform, making the overall experience more user-friendly.

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