Title: Report on Multi-Agent Volleyball Game Program

Introduction:

This report provides a summary of the multi-agent volleyball game program developed by our team. The program is designed to offer an interactive and engaging experience for users interested in user interaction technology. It includes features such as multiple roles, custom environment, different reward mechanisms, MAPPO algorithm training, visualization using Webots, and user control via keyboard input.

Program Description:

The program is structured into various modules, including:

Multi-Agent Environment: A custom gym-based environment is created to simulate the volleyball game, accommodating multiple agents and their interactions.

Role-Based Agents: Each agent represents a specific role within the game, possessing unique characteristics and behaviors.

Reward Mechanisms: Different reward functions are implemented for each role, guiding agents to learn appropriate strategies and behaviors.

MAPPO Training: The Multi-Agent Proximal Policy Optimization (MAPPO) algorithm is employed to train the agents and optimize their policies in the game.

Visualization: The game's visual representation is facilitated by integrating Webots, which provides a graphical display of the volleyball game and the agents' actions.

User Control Module: Users can interact with the game by inputting specific commands through keyboard numbers to control a selected agent's movements and actions.

Implemented Requirements:

The program targets students, researchers, and developers interested in user interaction technology and multi-agent systems. The specific requirements and functionalities achieved are as follows:

Interactive Learning Experience: Users can actively participate in the game, interacting with intelligent agents and learning about multi-agent systems through real-time engagement.

Multi-Agent Collaboration and Competition: Users can join one of the teams and experience cooperation or competition with other agents, enhancing their understanding of collaborating with intelligent agents to achieve game objectives.

Exploring Multi-Agent Systems: The program offers a practical environment for users to explore and study the characteristics and behaviors of multi-agent systems, observing agent interactions, and experimenting with different input commands to influence agent behavior.

The user control module and the ability to input commands via the keyboard demonstrate user interaction and user-friendliness.

Strengths and Weaknesses:

The program possesses several strengths:

Interactive Learning: Users can actively participate in the game and experience firsthand the dynamics of multi-agent systems.

Customizable Environment: The program allows customization of the game environment, rules, and reward mechanisms, providing flexibility for experimentation and learning.

Integration of MAPPO Algorithm: The use of the MAPPO algorithm enables intelligent agents to learn and adapt their strategies based on the game context and opponents' actions.

User Control: The ability for users to control an agent through keyboard input enhances the interactivity and engagement of the game.

However, there are some limitations that should be addressed:

Multi-Agent Collaboration Performance: Ensuring effective collaboration among agents can be challenging in complex multi-agent systems, and further optimization may be required to improve collaboration capabilities.

User Control Experience: Keyboard input for agent control might limit precision and fluidity compared to more intuitive input methods like game controllers or touch screens. Exploring alternative control mechanisms can enhance the user experience.

Game Content Diversity: The repetitive nature of volleyball gameplay might reduce long-term engagement. Introducing additional game elements or level designs can enhance variety and longevity.

Plan for Improvement:

To improve the program, the following steps can be considered:

Enhanced Agent Collaboration: Further research and experimentation can be conducted to improve the collaboration and coordination among agents, fostering more sophisticated team dynamics.

User-Friendly Controls: Exploring alternative input methods, such as game controllers or gesture recognition, can provide a more intuitive and immersive user control experience.

Game Content Expansion: Introducing additional game modes, challenges, or dynamic environments can increase the diversity and replayability of the game.

Contributions of Each Team Member:

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