**Project Title:** Dynamic Fighter Swapping Mechanic in Street Fighter (Warriors Showdown)

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**1. Project Overview**

**Project Topic:**  
This project focuses on enhancing the gameplay of **Street Fighter** by introducing a **fighter swapping mechanic**, allowing players to **switch between two fighters** during combat. This innovation adds strategic depth, requiring players to manage health, special moves, and fighter advantages dynamically.

**Objective:**  
The goal of this project is to develop an AI system that can **strategically control fighter swapping**, optimizing combat decisions. The AI will evaluate **when to swap fighters** based on health, opponent moves, and advantageous matchups, improving gameplay balance and engagement.

**2. Game Description**

**Original Game Background:**  
Street Fighter is a classic **2D fighting game** where players engage in **one-on-one** combat using various characters, each with unique abilities and fighting styles. The game involves executing attacks, blocking, and using special moves to defeat opponents.

**Innovations Introduced:**

* **Fighter Swapping Mechanic:** Each player controls **two fighters** and can switch between them mid-fight.
* **Health and Stamina Strategy:** Players must decide when to swap based on **fighter health, stamina, and enemy weaknesses**.
* **Swap Cooldown System:** To prevent excessive swapping, a **cooldown** will be implemented.
* **AI-Driven Swapping:** The AI will intelligently decide **when to swap** fighters based on in-game conditions, enhancing challenge and strategy.
* **New Game Modes:** A **tag-team mode** where players must **strategically manage two fighters**.

*Impact on Gameplay:*

* **Increases Tactical Depth** – Players must now **plan for two characters**, not just one.
* **More Balanced Fights** – If one fighter is weak against an opponent, **swapping allows counterplay**.
* **New AI Challenges** – The AI must analyze **fighter health, attack patterns, and opponent strategy** to decide optimal swaps.

**3. AI Approach and Methodology**

**AI Techniques to be Used:**

* **State Evaluation for Fighter Swapping:** AI will assess real-time **health, stamina, and attack effectiveness** to decide swaps.
* **Minimax Algorithm with Swapping Strategy:** Evaluates fighter advantage and swap decisions to maximize win probability.
* **Reinforcement Learning (Optional):** Train an AI to learn **optimal swap timing** based on past fights.
* **Alpha-Beta Pruning:** Optimizes AI move selection by eliminating weaker decision branches.

**Heuristic Design:**

* **Health-Based Swapping:** AI swaps if the current fighter’s health is critically low.
* **Matchup Advantage:** AI considers if the backup fighter has a **better attack effectiveness** against the opponent.
* **Cooldown Management:** AI avoids swapping too frequently to maintain balance.

**Complexity Analysis:**

* **State Space Complexity:** Fighter swapping increases the number of possible game states.
* **Decision Tree Growth:** AI must evaluate additional **fighter swap options** beyond normal move decisions.
* **Optimization Challenges:** Ensuring the AI swaps efficiently without unnecessary switches.

**4. Game Rules and Mechanics**

**Modified Rules:**

* Each player selects **two fighters** instead of one.
* Players can swap fighters **at any time**, but each swap triggers a **5-second cooldown**.
* Fighters **regain slight stamina** when inactive.

**Winning Conditions:**

* A player wins when **both opponent’s fighters are knocked out**.

**Turn Sequence:**

* Players fight as usual but can press a swap button to **switch to their second fighter**.
* AI-controlled opponents will **swap fighters** based on pre-defined strategies.

**5. Implementation Plan**

**Programming Language:** Python (or C++ if using an existing Street Fighter engine mod)

**Libraries and Tools:**

* **Pygame** (for GUI and fight animations)
* **OpenAI Gym** (for reinforcement learning if used)
* **NumPy** (for AI decision-making calculations)
* **TensorFlow/PyTorch** (for AI training, if reinforcement learning is applied)

**Milestones and Timeline:**

* **Week 1-2:** Define game mechanics and swap logic.
* **Week 3-4:** Implement AI decision-making (Minimax and heuristics).
* **Week 5-6:** Integrate AI with game mechanics and fighter swapping.
* **Week 7:** Testing and debugging.
* **Week 8:** Final optimizations, testing, and report preparation.

**6. References**

* Research papers on **AI in fighting games**.
* OpenAI articles on **game AI and reinforcement learning**.
* Game development guides for **Street Fighter mechanics**.