NationalUniversity of Computer & Emerging Sciences -NUCES - Karachi

Proposal for AI-Driven Snake and Ladder Game

Project Title:

AI-Enhanced Snake and Ladder with Dynamic Snakes & Ladders Placement

Submitted By:

1. Ibrahim Ahmed [22K-4341]
2. Umar Aurangzeb [22K-4139]
3. Anas Khan [22K-4483]

Course:

Artificial Intelligence

Instructor:

Lab: Sir Abdullah Yaqoob

Theory: Miss Fiza Aqeel

Submission Date:

3/10/2025

1. Project Overview:-

Project Topic:

The project is an AI-powered Snake and Ladder game where snakes and ladders are dynamically placed by an AI agent based on the player's predicted movement.

Objective:
Develop an AI-based Snake and Ladder game with Monte Carlo Simulation and Markov Chains to dynamically adjust board difficulty.

2. Game Description:-

Original Game Background:
Snake and Ladder is a board game where players move forward based on dice rolls, using ladders to advance and avoiding snakes.

Innovations Introduced:
Dynamic placement of snakes and ladders using AI predictions, game phase-based difficulty adjustment, and strategic AI decisions.

3. AI Approach and Methodology:-

AI Techniques to be Used:
Monte Carlo Simulation, Markov Chains, Utility-Based AI.

Heuristic Design:
Win probability, game phase adjustments, and strategic board modifications.

Complexity Analysis:
Monte Carlo Simulation: $O(N)$, Markov Chains: $O(N^2)$.

4. Game Rules and Mechanics:-

Modified Rules:
The player will **play against time** instead of competing with another player. The user can choose one of **three difficulty modes**:

- **Easy Mode:**
    - More time to reach the goal.
    - **Fewer snakes** and **more ladders** to make the game easier.
- **Medium Mode:**

- ○ Moderate time to reach the goal.
- ○ **Equal number of snakes and ladders** for balanced gameplay.
- ● **Hard Mode:**
  - ○ Less time to reach the goal.
  - ○ **More snakes** and **fewer ladders**, making it the most challenging mode.

Winning Conditions:

The player **wins the game** if they reach the **100th cell** within the given time limit for their selected difficulty mode.

Turn Sequence:

Player rolls a die, the AI updates the board (add snakes or ladders) , and the player moves accordingly.

5. Implementation Plan:-

Programming Language:

Frontend: React.js or Python GUI libraries like Tkinter.

Backend: Python and its libraries.

Milestones and Timeline:-

Week 1-2: Game design, Week 3-4: AI development, Week 5-6: Coding, Week 7: AI integration, Week 8: Final testing.

6. References:-

Research papers on Monte Carlo Simulation, Markov Chains, AI game development.