****

**AI-Powered Ludo: A Smart Board Game with Interactive Challenges and Special Power-Ups**

**GROUP MEMBERS:**

* AREEBA FATIMA
* RAFIA JAMIL
* ANAKSHA JANKI

**INSTRUCTOR:** SIR MUHAMMAD KHALID

**1. Introduction** Ludo is a classic board game played worldwide, known for its simplicity and engaging gameplay. However, in this project, we aim to modernize Ludo by integrating Artificial Intelligence (AI) and interactive puzzle challenges to make the game more strategic, engaging, and unpredictable.

The key modifications introduced in this AI-enhanced version of Ludo include:

* **Puzzle Challenge for the First Kill:** When a player tries to capture (kill) the first opponent's token, they must solve an AI-generated puzzle to complete the kill. If they fail, the opponent’s token remains safe, and they must try again in a later turn.
* **Special Power Tiles:** Certain tiles on the board will provide unique abilities to players, such as an extra roll, instant token capture without a puzzle, or immunity from being killed.
* **AI-Based Adaptive Puzzles:** The puzzles will vary in difficulty based on the player's progress, ensuring an engaging and balanced experience.

By incorporating AI-driven challenges and power-ups, this version of Ludo will introduce new layers of strategy, problem-solving, and unpredictability while maintaining the core fun elements of the original game.

**2. Objectives** The primary objectives of this project are:

* Enhance Ludo gameplay by integrating AI-generated puzzles that players must solve to capture their first opponent’s token.
* Introduce special power tiles that provide unique abilities, making the game more dynamic and strategic.
* Develop AI-based puzzles with varying difficulty levels to test player skills and add an element of challenge.
* Improve player engagement by combining traditional board game mechanics with interactive AI-based decision-making.
* Create a digital version of Ludo that can be played on a web-based or mobile platform, ensuring accessibility and ease of play.

**3. Features & Modifications**

### **3.1 Puzzle Challenge for First Token Capture**

* When a player attempts to kill their first opponent’s token, they must solve a puzzle before the capture is confirmed.
* If the player solves the puzzle, the opponent’s token is removed as per normal Ludo rules.
* If they fail the puzzle, the token remains safe, and the player must try again in a later turn.
* The puzzle difficulty adjusts based on player skill level, ensuring a fair challenge.

**Example puzzle types:**

* **Pattern Matching** (Match symbols or colors in a specific sequence)
* **Math Puzzles** (Solve quick arithmetic problems)
* **Logic Puzzles** (Find the missing piece or solve a riddle)

### **3.2 Special Power Tiles**

Some tiles on the board will provide special abilities when landed on. These include:

* **Extra Dice Roll:** The player gets an additional turn.
* **Instant Kill Tile:** The player can eliminate an opponent’s token without solving a puzzle.
* **Immunity Shield:** The player’s token is safe from being killed for a set number of turns.
* **Teleportation Tile:** The player can move their token to a different position on the board.
* **Skip Opponent’s Turn:** The next player loses a turn, adding a strategic element.

### **3.3 AI-Based Adaptive Puzzles**

* AI will analyze player performance and adjust the difficulty of puzzles dynamically.
* The more a player wins puzzles, the harder they become, ensuring progressive difficulty.
* AI will track player responses and provide hints or adjust the puzzle format if a player struggles.

**4. Technologies to be Used**

| **Component** | **Technology** |
| --- | --- |
| Front-End (Game Interface) | HTML, CSS, JavaScript (React.js or Vue.js) |
| Back-End (Game Logic & AI) | Python (Flask or Django) or Node.js |
| AI for Puzzle Generation | Python (TensorFlow, OpenCV for visual puzzles) |
| Database (Player Progress Tracking) | MySQL or Firebase |
| Game Engine (if needed for advanced UI) | Unity (C#) or Phaser.js |

**5. Expected Outcomes** By the end of this project, we expect to achieve:

* A fully functional digital Ludo game with AI-driven modifications.
* Puzzle integration that enhances strategic gameplay.
* A power tile system that adds an extra layer of excitement and unpredictability.
* An AI system that adjusts puzzle difficulty based on player skills.
* A fun, engaging multiplayer or AI-based single-player mode.

**6. Possible Future Enhancements**

* **Multiplayer Mode:** Online or local multiplayer with interactive challenges.
* **Leaderboard & Achievements:** Track player performance and provide rewards.
* **Custom Puzzles:** Players can create their own puzzles for others.
* **AI Opponent:** A fully AI-controlled Ludo opponent that learns and adapts.
* **Augmented Reality (AR) Mode:** If extended, AR features can be added for a more immersive experience.

**7. Timeline & Milestones**

| Phase | Task | Duration |
| --- | --- | --- |
| Phase 1 | Research & Planning | 1 Week |
| Phase 2 | Game Board & UI Design | 1 Week |
| Phase 3 | Implement Ludo Core Logic | 1 Week |
| Phase 4 | Develop AI-Powered Puzzle System | 2 Weeks |
| Phase 5 | Integrate Special Power Tiles | 2 Weeks |
| Phase 6 | Testing & Debugging | 1 Week |
|  |  |  |
| **Total Estimated Time:** | **2 Months** |  |

**8. Conclusion**

This project aims to enhance traditional Ludo gameplay using AI, making it more interactive, strategic, and engaging. By introducing puzzle-based token captures and special power tiles, we create a game that is not only fun but also challenges players' thinking skills.

With AI-driven mechanics, adaptive puzzles, and power-ups, this AI-enhanced Ludo will offer a fresh take on a beloved classic, ensuring entertainment and strategy for all players.