

The Evolving Maze

Artificial Intelligence Project Proposal

Submitted By

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➤ Project Title:

The Evolving Maze: An AI-Powered Adaptive Maze Game

➤ Introduction:

Traditional board games and maze-solving puzzles are static in design and predictable after repeated gameplay. This project proposes an unconventional AI-based board game — *The Evolving Maze* — where the challenge dynamically adapts in real-time based on the player's movements.

Artificial Intelligence techniques such as Genetic Algorithms, Heuristic evaluation, and Pathfinding algorithms will be used to create an engaging and ever-changing game environment. The maze gets harder as the player progresses toward the goal, but the system ensures that it always remains solvable.

➤ Problem Statement:

Most maze games lack adaptability, leading to repetitive gameplay. This project aims to:

- Dynamically evolve the maze based on the player's proximity to the target.
 - Ensure increasing difficulty as the player nears the goal.
 - Maintain solvability using AI-based validation techniques.
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➤ Objectives:

- Develop a maze game that evolves during gameplay.
 - Implement AI (Genetic Algorithm) to evolve maze configurations.
 - Use BFS to validate maze solvability after each evolution.
 - Create an interactive interface where the player navigates the maze.
 - Provide real-time difficulty scaling based on player movement.
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➤ Scope of the Project:

- A command-line or GUI-based interactive maze game.
 - Maze generation and evolution using AI techniques.
 - Dynamic difficulty adjustment without compromising solvability.
 - Single-player experience that mimics an AI Dungeon Master.
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➤ Methodology:

Game Design:

- 2D maze with walls (#), path (.), player (P), and goal (G).
- Player can move using W/A/S/D keys.

AI Algorithms:

Technique	Role
Genetic Algorithm	To evolve maze structure and introduce new obstacles.
Mutation Operator	Randomly increases challenge around the player's path.
Manhattan Distance	Used to check how close the player is to the goal.
Breadth-First Search (BFS)	Ensures that after each mutation, the maze still has a valid path.

Expected Outcomes:

- A playable maze game with adaptive, AI-driven mechanics.
 - Demonstration of AI application in dynamic puzzle design.
 - Greater player engagement due to non-linear difficulty.
 - Clear documentation and maintainable codebase for future work.
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➤ Tools and Technologies:

Tool	Purpose
Python 3.x	Core programming language
Random, Collections	Maze generation and traversal
Custom AI modules	Genetic algorithm and mutation handling

➤ Conclusion:

The Evolving Maze will demonstrate how AI can be applied in board game mechanics to create an adaptive and intelligent game environment. It merges algorithmic decision-making with entertainment to provide a novel gaming experience while showcasing real-time AI application.