Green University of Bangladesh

Department of Computer Science and Engineering (CSE)

AI Maze Solver using BFS/DFS/A* Algorithms

Course Title: Artificial Intelligence Lab
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0.1 TITLE OF THE PROJECT PROPOSAL

AI Maze Solver using BFS/DFS/A* Algorithms - Educational AI Visualization Tool

0.2 PROJECT OVERVIEW

The AI Maze Solver is an interactive educational application that demonstrates and compares three fundamental path finding algorithms: Breadth-First Search (BFS), Depth-First Search (DFS), and A Search*. This project provides real-time visualization of how these artificial intelligence algorithms navigate through maze environments, transforming abstract computational concepts into tangible, interactive learning experiences.

0.3 OBJECTIVES/AIMS

This project aims to develop an interactive educational tool that demonstrates and compares three fundamental path finding algorithms: Breadth-First Search (BFS), Depth-First Search (DFS), and A* Search. The application will provide real-time visualization of how these algorithms navigate through maze environments, making abstract AI concepts tangible and understandable.

- Implement three core pathfinding algorithms (BFS, DFS, A*) with accurate computational behavior

- Create interactive maze environments with customizable layouts and difficulty levels

- Develop real-time visualization showing algorithm exploration and path discovery

- Provide comparative analysis of algorithm performance and characteristics

0.4 PROPOSED FEATURES

1. **Multiple Algorithm Support**

   (a) Breadth-First Search (BFS) with queue implementation.

   (b) Depth-First Search (DFS) with stack implementation.

   (c) A* Search with Manhattan distance heuristic.

2. **Interactive Maze System**

   (a) Pre-generated maze templates of varying difficulty

   (b) Random maze generation capability

   (c) Custom maze creation tools

   (d) Adjustable maze dimensions and complexity

3. **Real-time Visualization**

   (a) Color-coded cell states (start, end, path, visited, walls)

   (b) Step-by-step algorithm execution

   (c) Live path construction animation

   (d) Exploration frontier visualization

0.5 METHODOLOGY

This methodology provides a structured yet flexible approach to developing the AI Maze Solver project. By combining:

- Iterative development for continuous improvement

- Comprehensive testing for reliability

- Educational focus for maximum impact

- Technical rigor for algorithm accuracy

The methodology ensures the project delivers both a technically sound application and an effective educational tool, meeting all objectives while maintaining high quality standards throughout the development life-cycle.
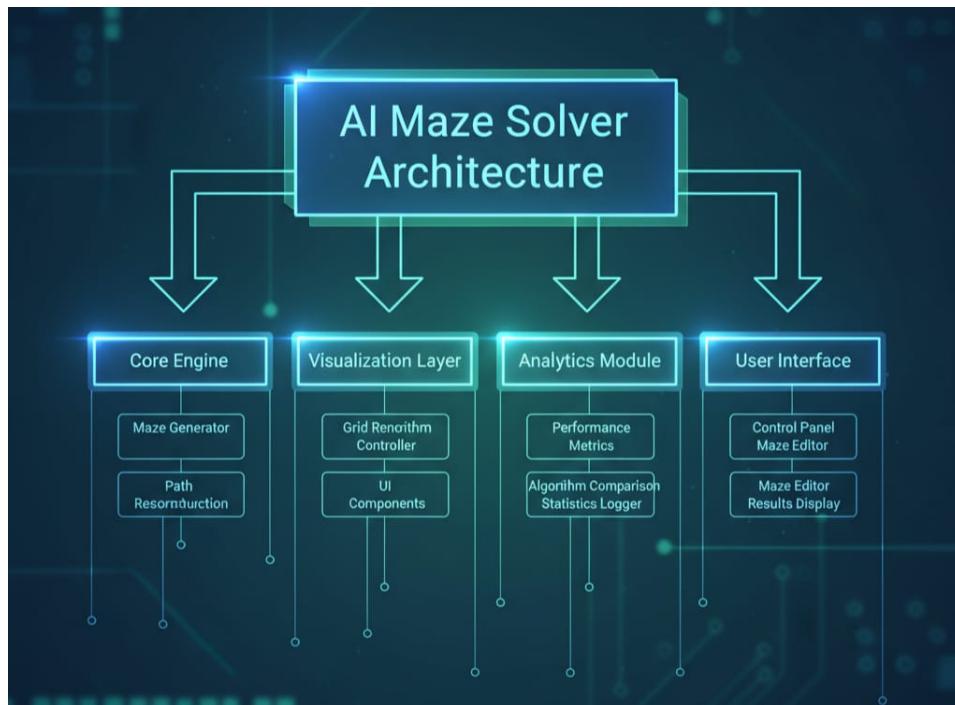
Fig: AI Maze Solver Architecture

0.6 TOOLS AND TECHNOLOGIES

- **Programming Language:**Python.
- **Graphics Library:**Pygame.
- **Development Environment:**PyCharm.
- **Documentation:**LaTeX.

0.7 CONCLUSION

The AI Maze Solver project represents an excellent opportunity to bridge theoretical algorithm knowledge with practical visual understanding. By creating an interactive platform that demonstrates the BFS, DFS, and A* algorithms in action, this project will serve as both a valuable learning tool and a demonstration of fundamental AI concepts.