MMI 513 Term Project, Spring 2024

Dynamic Maze Generation with Time-Dependent Randomness and Pathfinding

Project Description:

Develop a dynamic maze generation system with time-dependent randomness where maze walls can disappear or appear randomly at specified intervals. The project will include implementing pathfinding algorithms to navigate through the changing maze. This project will incorporate random number generation, maze generation techniques, dynamic updates, and pathfinding algorithms. You will work in groups of two.

Objectives:

1. **Randomized Maze Generation:** Use random number generation methods to create the initial maze layout. Implement maze generation algorithms (e.g., depth-first search, Prim's algorithm) to produce the initial maze structure.
2. **Time-Dependent Randomness:** Introduce a mechanism to randomly add or remove maze walls at specified time intervals. Ensure the changes maintain the solvability of the maze by dynamically recalculating paths and adjusting the maze structure.
3. **Pathfinding:** Discretize the maze into a grid. Implement the A* algorithm to find the optimal path from the maze entrance to the exit. Allow for real-time visualization of the pathfinding process, adapting to changes in the maze structure.

Deliverables:

1. **Technical Report** (4 pages in IEEE transactions format): Overview of the project written collaboratively by the team, including problem statement, objectives, and methodology. Detailed description of the maze generation, time-dependent randomness, and pathfinding algorithms used. Discussion of challenges encountered and solutions implemented.

2. **Python Code:** Well-documented code uploaded as a ZIP file Including README file with instructions on how to set up and run the project.

3. **Presentation and Demonstration:** A video uploaded to Youtube where you explain your approach also including a live demonstration of the dynamic maze with time-dependent randomness and pathfinding process. You will submit the link to this video as part of your term project submission.

4. **Self and peer assessment document:** A report written individually by each team member detailing their contributions and their partner's contributions.

Evaluation Criteria:

1. **Creativity and Complexity:** Novelty and depth of the dynamic maze generation and time-dependent randomness.

2. **Algorithm Implementation:** Correctness and efficiency of the algorithms used.

3. **Documentation and Presentation:** Clarity, thoroughness, and professionalism of the report and presentation.

Note: You are encouraged to use LLMs like ChatGPT-4 for brainstorming, troubleshooting, and code review but must ensure that your final implementation and solutions are original and unique.

Grading

Criteria	Excellent (90-100%)	Good (75-89%)	Satisfactory (60-74%)	Needs Improvement (50-59%)	Poor (<50%)
Maze Generation	Efficient implementation, highly creative, and produces complex, varied mazes	Functional implementation, creative, produces varied mazes	Basic implementation, limited creativity, produces simple mazes	Partially functional, lacks creativity, produces repetitive mazes	Non-functional or very basic implementation, no creativity
Time-Dependent Randomness	Robust mechanism, seamless integration, maintains solvability, frequent updates	Functional mechanism, good integration, maintains solvability, occasional updates	Basic mechanism, integration needs improvement, solvability sometimes affected, infrequent updates	Partially functional mechanism, poor integration, solvability often compromised, rare updates	Non-functional or very basic mechanism, no updates or solvability compromised
Pathfinding Algorithm	Highly efficient and accurate, adapts smoothly to changes, clear real-time visualization	Efficient and accurate, adapts well to changes, good real-time visualization	Basic accuracy and efficiency, adapts to most changes, adequate visualization	Partially functional, struggles with changes, poor visualization	Non-functional or very basic implementation, fails to adapt to changes
Technical Report	Comprehensive, clear, detailed methodology, thorough discussion of challenges and solutions	Clear, detailed methodology, good discussion of challenges and solutions	Adequate methodology, some discussion of challenges and solutions	Basic methodology, minimal discussion of challenges and solutions	Incomplete or unclear methodology, no discussion of challenges and solutions
Code Quality	Well-documented, clean, modular, easy to understand and modify	Well-documented, clean, some modularity, mostly easy to understand	Adequately documented, some code cleanliness, limited modularity	Partially documented, code is difficult to read and understand	Poorly documented or undocumented, messy code, hard to understand
Presentation	Clear, engaging, comprehensive explanation, excellent demonstration	Clear and engaging explanation, good demonstration	Adequate explanation and demonstration	Basic explanation, minimal demonstration	Poor explanation, little to no demonstration
Creativity and Innovation	Highly creative and innovative approach, exceeds expectations	Creative approach, meets expectations	Some creativity, meets basic expectations	Minimal creativity, below expectations	Lacks creativity and innovation, does not meet expectations
Individual Contribution	Clear, substantial contribution to the project, actively participated in all aspects, demonstrated strong teamwork	Good contribution to the project, participated in most aspects, demonstrated good teamwork	Adequate contribution to the project, participated in some aspects, demonstrated adequate teamwork	Minimal contribution to the project, limited participation, demonstrated poor teamwork	Little to no contribution to the project, minimal participation, demonstrated very poor teamwork

Detailed Breakdown:

1. **Maze Generation (20%)**

    - **Excellent:** Highly efficient and creative implementation producing complex and varied mazes.
    - **Good:** Functional and creative implementation with varied maze generation.
    - **Satisfactory:** Basic implementation with limited creativity and simple mazes.
    - **Needs Improvement:** Partially functional with repetitive maze generation.
    - **Poor:** Non-functional or very basic implementation.

2. **Time-Dependent Randomness (20%)**

    - **Excellent:** Robust mechanism with seamless integration, maintaining solvability with frequent updates.
    - **Good:** Functional mechanism with good integration and occasional updates.
    - **Satisfactory:** Basic mechanism with some integration issues and infrequent updates.
    - **Needs Improvement:** Partially functional mechanism with poor integration and rare updates.
    - **Poor:** Non-functional or very basic mechanism.

3. **Pathfinding Algorithm (20%)**

    - **Excellent:** Highly efficient, accurate, and adaptive to changes with clear real-time visualization.
    - **Good:** Efficient and accurate with good adaptation and visualization.
    - **Satisfactory:** Basic accuracy and efficiency with adequate visualization.
    - **Needs Improvement:** Partially functional with poor adaptation and visualization.
    - **Poor:** Non-functional or very basic implementation.

4. **Technical Report (15%)**

    - **Excellent:** Comprehensive, clear, and detailed report with thorough discussion of methodology, challenges, and solutions.
    - **Good:** Clear and detailed report with good discussion.
    - **Satisfactory:** Adequate report with some discussion.
    - **Needs Improvement:** Basic report with minimal discussion.
    - **Poor:** Incomplete or unclear report.

5. **Code Quality (15%)**

    - **Excellent:** Well-documented, clean, modular code that is easy to understand and modify.
    - **Good:** Well-documented and clean code with some modularity.
    - **Satisfactory:** Adequately documented with some code cleanliness.
    - **Needs Improvement:** Partially documented with messy code.
    - **Poor:** Poorly documented or undocumented with messy code.

6. **Presentation (5%)**

    - **Excellent:** Clear, engaging, and comprehensive explanation with an excellent demonstration.
    - **Good:** Clear and engaging explanation with a good demonstration.
    - **Satisfactory:** Adequate explanation and demonstration.
    - **Needs Improvement:** Basic explanation with minimal demonstration.
    - **Poor:** Poor explanation with little to no demonstration.

7. **Creativity and Innovation (5%)**

    - **Excellent:** Highly creative and innovative approach exceeding expectations.
    - **Good:** Creative approach meeting expectations.
    - **Satisfactory:** Some creativity meeting basic expectations.
    - **Needs Improvement:** Minimal creativity below expectations.
    - **Poor:** Lacks creativity and innovation, not meeting expectations.

8. **Individual Contribution (10%)**

    - **Excellent:** Clear, substantial contribution to the project, actively participated in all aspects, demonstrated strong teamwork.
    - **Good:** Good contribution to the project, participated in most aspects, demonstrated good teamwork.
    - **Satisfactory:** Adequate contribution to the project, participated in some aspects, demonstrated adequate teamwork.
    - **Needs Improvement:** Minimal contribution to the project, limited participation, demonstrated poor teamwork.
    - **Poor:** Little to no contribution to the project, minimal participation, demonstrated very poor teamwork.

Grading Individual Contributions:

- Each student will be required to submit a self-assessment and a peer assessment detailing their contributions and their partner's contributions.
- Individual grades will be adjusted based on self-assessment, peer assessment, and the interview to ensure fair evaluation of each student's work.