Green University of Bangladesh

Department of Computer Science and Engineering (CSE)
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Path-finding in Maze using different Algorithm and Comparisons

Course Title: Algorithms Lab
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Students Details

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Lab Project Status	
Marks:	**Signature:**
Comments:	**Date:**

Contents

Chapter 1

Introduction

1.1 Overview

The problem of pathfinding in a maze is a classic and fundamental topic in computer science and artificial intelligence. It involves finding the most efficient route from a designated start point to a specified end point within a maze, which is typically represented as a grid with obstacles and open paths. This problem has wide-ranging applications in various domains, including robotics, video games, network routing, and logistics, where efficient navigation is crucial.

1.2 Motivation

The motivation behind studying pathfinding in a maze lies in its real-world applicability and the need for efficient solutions to navigate complex environments. As technology advances, the demand for intelligent systems capable of autonomously finding optimal paths becomes increasingly prevalent. From guiding robots through cluttered spaces to enhancing user experiences in video games, the ability to solve maze navigation problems is integral to the development of intelligent and adaptive systems. [1].

1.3 Problem Definition

1.3.1 Problem Statement

The problem can be formally defined as follows: Given a maze represented as a grid with specified start ('S') and end ('E') points, along with obstacles represented by '' and open paths denoted by '.', the task is to determine the shortest path from the start to the end while avoiding obstacles. Various algorithms can be employed to solve this problem, each with its own set of strengths and weaknesses.

1.3.2 Complex Engineering Problem

Table 1.1 The pathfinding problem in a maze is a complex engineering challenge that encompasses several key aspects:

Table 1.1: Summary of the attributes touched by the mentioned projects

Name of the P Attributess	**Explain how to address**
P1: Depth of knowledge required	-Employed a systems engineering approach to identify, prioritize, and manage conflicting requirements. Utilized techniques such as requirement traceability matrices and trade-off analyses to balance conflicting demands. Clearly defined design constraints and use decision support tools to optimize the trade-offs.
P2: Range of conflicting requirements	—-
P3: Depth of analysis required	Undertook a detailed analysis of the problem, considering the complexities introduced by different maze structures, algorithmic choices, and user interactions. Use algorithmic analysis to evaluate the time and space complexity of pathfinding algorithms. Performed sensitivity analyses to understand the impact of parameter variations.
P4: Familiarity of issues	Conducted a thorough review of existing solutions, best practices, and common challenges related to pathfinding in mazes. Engaged with the relevant literature and case studies to gain insights into common issues and successful strategies.
P5: Extent of applicable codes	—-
P6: Extent of stakeholder involvement and conflicting requirements	—-
P7: Interdependence	—-

1.4 Design Goals/Objectives

The primary objective of this project is to implement and analyze different pathfinding algorithms to find the optimal solution to the maze navigation problem. The project encompasses the design and implementation of user-friendly interfaces, incorporation of multiple maze generation algorithms, inclusion of various pathfinding algorithms (such as Breadth-First Search, Depth-First Search, Dijkstra's Algorithm, and A*), and the provision of features allowing users to customize and compare algorithmic performances. The project aims to provide an educational and interactive platform for users to explore the intricacies of pathfinding algorithms.

1.5 Application

The applications of pathfinding in a maze are diverse and impact several key domains, showcasing its significance in various real-world scenarios:

1.5.1 Robotics and Autonomous Vehicles:

Pathfinding algorithms are crucial for guiding robots and autonomous vehicles through complex environments, ensuring safe and efficient navigation in both industrial and public spaces.

1.5.2 Video Games and Virtual Environments:

In the realm of entertainment and simulations, pathfinding plays a vital role in creating lifelike and intelligent behaviors for characters and entities. This is essential for designing engaging and challenging gameplay experiences.

1.5.3 Network Routing and Traffic Management:

Pathfinding algorithms contribute to the optimization of network routes, aiding in efficient data transmission and traffic management in communication networks and the internet. This is particularly relevant in the context of data centers and routing protocols.

1.5.4 Logistics and Supply Chain Optimization:

The logistics industry relies on pathfinding to optimize delivery routes, reduce transportation costs, and enhance overall supply chain efficiency. It helps in determining the most cost-effective and timely paths for goods and services.

1.5.5 Urban Planning and Infrastructure Design:

City planners use pathfinding techniques to analyze pedestrian and vehicular movement, contributing to the design of efficient transportation systems, public spaces, and infrastructure layouts.

1.5.6 Routing in Geographic Information Systems (GIS):

Geographic information systems leverage pathfinding algorithms for routing applications, guiding users through maps, suggesting optimal routes for navigation, and facilitating location-based services.

1.5.7 Artificial Intelligence and Decision Support Systems:

Pathfinding algorithms are integral components of decision support systems and AI applications, aiding in intelligent decision-making processes across diverse domains, including finance, healthcare, and resource allocation.

1.5.8 Educational Tools and Simulations:

Pathfinding in mazes serves as a valuable educational tool, allowing students and enthusiasts to explore and understand the principles of algorithmic navigation in a visually intuitive manner.

By addressing the maze pathfinding problem, we not only tackle fundamental challenges in computer science but also contribute to the development of solutions that impact the efficiency and intelligence of systems across a wide range of applications, ultimately enhancing our technological landscape. In every section please add subsections and figures and citations as references [1] also.

Chapter 2

Design/Development/Implementation of the Project

2.1 Introduction

Start the section with a general discussion of the project [2] [3] [4].

2.2 Project Details

In this section, you will elaborate on all the details of your project, using subsections if necessary.

2.2.1 Subsection_name

Figure 2.1: Figure name

You can fix the height, width, position, etc., of the figure accordingly.

2.3 Implementation

All the implementation details of your project should be included in this section, along with many subsections.

2.3.1 Subsection_name

This is just a sample subsection. Subsections should be written in detail. Subsections may include the following, in addition to others from your own project.

The workflow

Tools and libraries

Implementation details (with screenshots and programming codes)

Each subsection may also include subsubsections.

2.4 Algorithms

The algorithms and the programming codes in detail should be included .
Pseudo-codes are also encouraged very much to be included in this chapter for your project.

- Bullet points can also be included anywhere in this project report.

Algorithm 1: Sample Algorithm

Input: Your Input
Output: Your output
Data: Testing set x

```
1  ∑_{i=1}^{∞} := 0                                   // this is a comment
   /* Now this is an if...else conditional loop                    */
2  if Condition 1 then
3      Do something                              // this is another comment
4      if sub-Condition then
5          Do a lot
6  else if Condition 2 then
7      Do Otherwise
       /* Now this is a for loop                                   */
8      for sequence do
9          loop instructions
10 else
11     Do the rest
   /* Now this is a While loop                                     */
12 while Condition do
13     Do something
```

Chapter 3

Performance Evaluation

3.1 Simulation Environment/ Simulation Procedure

Discuss the experimental setup and environment installation needed for the simulation of your outcomes.

3.1.1 Subsection

3.1.2 Subsection

3.2 Results Analysis/Testing

Discussion about your various results should be included in this chapter in detail.

3.2.1 Result_portion_1

The results of any specific part of your project can be included using subsections.

3.2.2 Result_portion_2

Each result must include screenshots from your project. In addition to screenshots, graphs should be added accordingly to your project.

3.2.3 Result_portion_3

Each result must have a single paragraph describing your result screenshots or graphs or others. This is a simple discussion of that particular portion/part of your result.

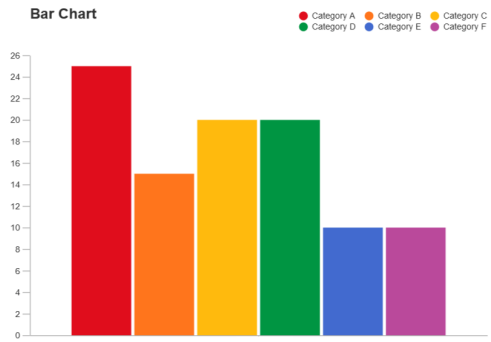

Figure 3.1: A graphical result of your project

3.3 Results Overall Discussion

A general discussion about how your result has arrived should be included in this chapter. Where the problems detected from your results should be included as well.

3.3.1 Complex Engineering Problem Discussion

[OPTIONAL] In this subsection, if you want, you can discuss in details the attributes that have been touched by your project problem in details. This has already been mentioned in the Table **??**.

Chapter 4

Conclusion

4.1 Discussion

Discuss the contents of this chapter and summarized the description of the work and the results and observation. Generally, it should be in one paragraph.

4.2 Limitations

Discuss the limitations of the project. Limitations must be discussed, with the help of some critical analysis.

4.3 Scope of Future Work

Discuss the future work of the project, that is your plans for more work and extension of your project.

References

[1] Omid C Farokhzad and Robert Langer. Impact of nanotechnology on drug delivery. *ACS nano*, 3(1):16–20, 2009.

[2] Uthayasankar Sivarajah, Muhammad Mustafa Kamal, Zahir Irani, and Vishanth Weerakkody. Critical analysis of big data challenges and analytical methods. *Journal of Business Research*, 70:263–286, 2017.

[3] Douglas Laney. 3d data management: controlling data volume, velocity and variety. gartner, 2001.

[4] MS Windows NT kernel description. http://web.archive.org/web/20080207010024/http://www.808multimedia.com/winnt/kernel.htm. Accessed Date: 2010-09-30.