Construction of a Program to Solve Shortest Path Problems in the Shortest Time Using Graph Theory

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***Abstract*—This thesis explores the construction of a program to solve shortest path problems in the shortest time using graph theory. It covers an overview of graph theory, various graph algorithms, and the application of the A* algorithm. The program is developed using Visual Basic.NET. The author discusses the challenges faced during the development process and highlights the completion of several key functionalities, including graph drawing, A* algorithm implementation, and path calculation. The program successfully implements the A* algorithm to solve shortest path problems, but does not provide specific numerical evaluations of the program's performance. The author suggests potential future improvements, such as incorporating real-time traffic data and integrating with a call center system.**

***Index Terms*—graph theory, A* algorithm, shortest path, Visual Basic.NET, heuristic search, program development**

I. Introduction

Graph theory, a field with extensive applications, has been studied since the early 18th century by mathematician Leonhard Euler. The thesis provides an overview of graph theory and its applications, including the use of graphs to model real-world problems such as traffic flow and network routing. The author introduces the A* algorithm, a heuristic search algorithm, and its implementation in the program. The program is developed using Visual Basic.NET, a language that the author found challenging to master due to its complexity [1]. Related earlier ICTU undergraduate theses provide context for this English summary [6], [7], [8]. Published articles on the methods and subject of this project provide context for this English summary [9], [10], [11].

II. Methods

The thesis describes the development of a program using Visual Basic.NET. It covers the implementation of various graph algorithms, such as Depth-First Search, Breadth-First Search, Dijkstra's algorithm, and the A* algorithm. The author also discusses the design and implementation of the user interface for the program. The program includes features such as graph drawing, A* algorithm implementation, and path calculation. The author notes that the development process was challenging due to the complexity of the Visual Basic.NET language and the need to integrate multiple algorithms [1].

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III. Results

The program successfully implements the A* algorithm to solve shortest path problems. The author reports that the program can calculate and estimate the shortest path and time. However, the thesis does not provide specific numerical evaluations of the program's performance. The program includes features such as graph drawing, A* algorithm implementation, and path calculation. The author suggests potential future improvements, such as incorporating real-time traffic data and integrating with a call center system [1].

IV. Discussion

The author notes that the program's development was challenging due to the complexity of the Visual Basic.NET language. The program includes features such as graph drawing, A* algorithm implementation, and path calculation. The author suggests potential future improvements, such as incorporating real-time traffic data and integrating with a call center system. The author acknowledges the limitations of the program, such as the need for more advanced features and a more sophisticated user interface. The author expresses hope for feedback from the Department of Information Technology at Thai Nguyen University [1]. Earlier ICTU undergraduate work by Lê Trần Linh addressed graph theory for practical problems [5].

V. Conclusion

The author reports a Visual Basic .NET program that draws graphs, estimates a shortest route and travel time with the A* algorithm, and saves or reopens graph data. The thesis also states that the program still lacks several functions and that its interface remains simple. These limits are linked to the author's first experience building an application in Visual Basic .NET. The work is best read as a completed graph-based demonstration with an identified development path, not as a measured comparison showing that its running time is optimal [1].

References

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