NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES

(KARACHI CAMPUS)

Project Proposal

Graph Theory

Project Proposal: Fiber Optic Trajectory Optimizing System (using Prim's and Kruskal's Algorithm)

Instructor

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Description:

The project aims to implement and compare various algorithms for finding minimum spanning trees (MSTs) in graphs, specifically focusing on their applications in optimizing fiber optic trajectory planning. The algorithms under consideration are the naive and efficient versions of Prim's and Kruskal's algorithms. The study involves implementing these algorithms in Python, conducting experiments on randomly generated graphs of different sizes and densities, and analyzing their performance in terms of running time, and practical implications for real-world scenarios.

Methodology:

Our optimization approach primarily involves the prevention of cycles within the graph. Both Prim's and Kruskal's algorithms rank the weights of edges and create a minimum spanning tree accordingly. To implement this system efficiently, we will employ data structures such as LINKED LIST, MIN-HEAP, and GRAPH.

Implementation Details:

- *Understand the fundamental concepts of graph theory, including vertices, edges, and weighted graphs.*
- *Explore the significance of spanning trees and minimum spanning trees in the context of network design and optimization.*

1. *Prim's Algorithm:* We will implement Prim's algorithm to generate the Minimum Spanning Tree (MST) of the adjacency list graph. The algorithm calculates the total weight of the MST by adding the weights of all edges in the MST one-by-one.

2. *Kruskal's Algorithm*: In addition to Prim's algorithm, we will also implement Kruskal's algorithm to generate the MST of the same inputted adjacency list graph. It is efficient for sparse graphs and will provide an alternative optimization approach.

2. **Deliverables:**

We will deliver an efficient Fiber Optic Trajectory Optimizing System that employs both Prim's and Kruskal's algorithms. The system will use LINKED LIST, MIN-HEAP, and GRAPH data structures for optimized trajectory planning. The key deliverables include:

1. Implementation of Prim's Algorithm for generating the Minimum Spanning Tree (MST) of the inputted adjacency list graph.

2. Implementation of Kruskal's Algorithm for generating the MST of the same inputted adjacency list graph.

3. A user-friendly interface for inputting data and visualizing the optimized fiber optic trajectory planning.

4. Comprehensive documentation including user guides and technical documentation detailing the system's functionality and algorithms employed.

5. Performance analysis comparing the results of Prim's and Kruskal's algorithms in terms of optimization and time complexity.

By combining both Prim's and Kruskal's algorithms, our system will offer a more comprehensive solution for optimizing fiber optic trajectory planning, allowing users to choose the algorithm that best suits their specific requirements.