Northern University

of Business and Technology Khulna

Department of Computer Science and Engineering

Project Proposal

Project Title:

Electric power grid planning using MST

Submitted By

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Course Title: Linear Programming and Combinatorial Optimization Lab

Course Code: CSE 2202

Section : 4B

Submitted To

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Project Overview:

The aim of this project is to develop a terminal-based application that optimizes the layout of an electric power grid using the Minimum Spanning Tree (MST) technique. The primary problem this project addresses is the efficient design of power transmission networks, which is crucial for minimizing construction and operational costs while ensuring reliable electricity delivery.

This project is significant because it offers a cost-effective and reliable method for power grid planning, which is essential for both developed and developing regions facing growing electricity demands.

Objectives:

- Develop a terminal-based application for electric power grid optimization.
- Implement the MST technique (using Prim's or Kruskal's algorithm) to find the optimal grid layout.
- Minimize the total cost of transmission lines while ensuring all substations are connected.
- Provide a visualization of the optimal power grid layout using Python libraries.
- Validate the application with sample datasets representing realistic power grid scenarios.

Literature Review:

- **Graph Theory and Network Algorithms:** These foundational concepts are crucial for understanding and implementing MST algorithms. Books like "Introduction to Graph Theory" by Robin J. Wilson and "Algorithms" by Robert Sedgewick provide comprehensive insights.

- **Minimum Spanning Tree Algorithms:** Prim's and Kruskal's algorithms are well-documented in the literature. Papers such as "On the Shortest Spanning Subtree of a Graph and the Traveling Salesman Problem" by R.C. Prim and "A Method for Finding the Minimum Spanning Tree" by J.B. Kruskal are seminal works.

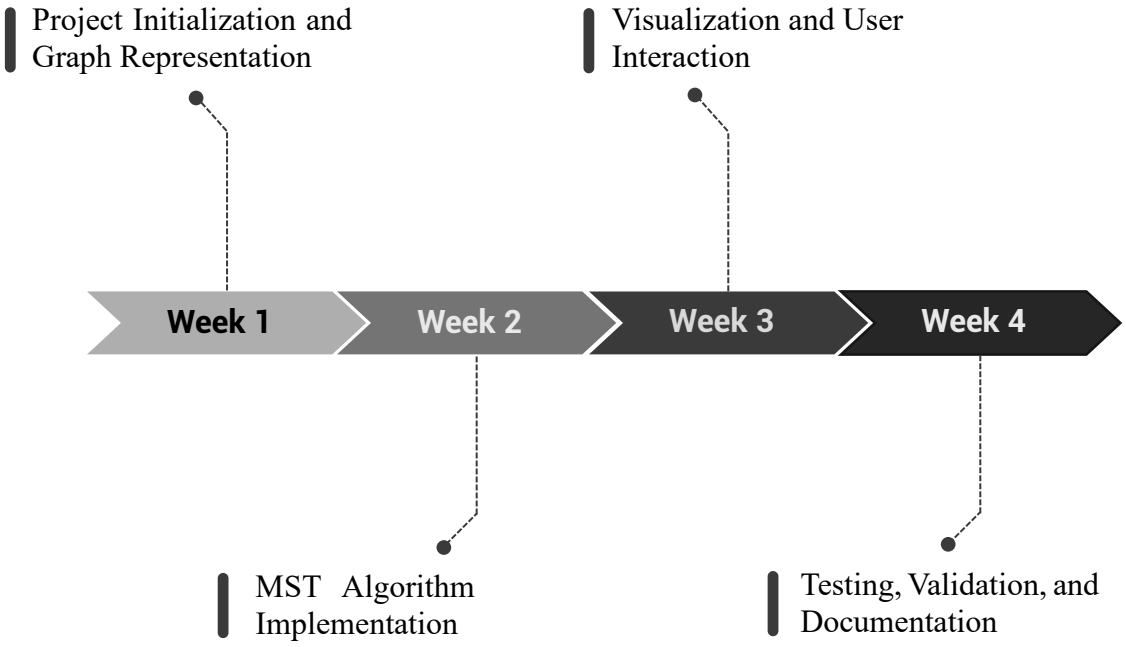
Methodology:

1. **Graph Representation:** Use NetworkX to represent the power grid as a graph where nodes are substations and edges are potential transmission lines with associated costs.
2. **Input Handling**: Develop a mechanism for users to input data about nodes and edges via the terminal.
3. **MST Calculation:** Implement Prim's or Kruskal's algorithm to compute the MST, which represents the optimal layout of transmission lines.
4. **Visualization:** Use Matplotlib to visualize the graph and highlight the MST.
5. **Testing and Validation:** Validate the application using sample datasets to ensure correctness and efficiency.

Expected Outcomes:

- A functional terminal-based application that can read input data, compute the MST, and output the optimal power grid layout.
- Visualization of the power grid and MST to provide a clear and intuitive understanding of the optimal layout.
- Documentation and user guide explaining how to use the application.
- Performance analysis and validation results demonstrating the application's effectiveness with sample datasets.

Project Timeline:



Resources Required:

1. **Software:** Python, NetworkX, Matplotlib.
2. **Hardware:** Standard computing resources (PC or laptop) capable of running Python.
3. **Data:** Access to sample datasets representing power grid scenarios for testing and validation.

References:

1. Wilson, R. J. (2010). Introduction to Graph Theory. Pearson.
2. Sedgewick, R. (2011). Algorithms. Addison-Wesley Professional.
3. Kruskal, J. B. (1956). "On the shortest spanning subtree of a graph and the traveling salesman problem." Proceedings of the American Mathematical Society, 7(1), 48-50.