An Efficient Method for Rural Electrification Grid Design

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Abstract: *The main objective of this thesis is to provide a framework for SEIMS by developers with the ability to record, store, and process power consumption data of every major appliance in the house and Industries. The power consumption data is accessible through the Web portal and on handheld devices. Homeowners and Industries can track their power usage by device, room, equipment, Plant or appliance, which helps better regulate power consumption. The key is to decide whether the demand is off-peak, mid- peak or on-peak dynamically and relay this information to smart appliances of select customer groups based on available supply. The Proposed work is to use the simple and efficient Prim's algorithm for the self-healing the node when any electricity line or power supply breakdown.In this project, we are going to simulate and implement the self-healing grid having the 12 nodes that act as the functional user of electricity and 2 power sources that act as the power plant or a power distribution center and there are relays that control the connection to multiple node to control or restore the fail node for restoration.*

Keywords*: Prims Algorithm, vertices, Edges, Smart Grid System, minimum spanning tree , electricity transmission line.*

I. INTRODUCTION

The prim's algorithm is used for the minimum spanning tree to carry out the optimization process. The project seeks to find how a network with a number of possible connections can have the least possible distance. The main objective of the optimization procedure is to minimize the total distance of the network connections, so as to minimize resources that are used when carrying out projects. The Rural Electrification Agency has been failing to meet their targets for extension of the electricity grid network because of shortage of resources and input capital, thus the researcher adopts the idea of network optimization as a way of saving resources so that they can be used for other projects. The researcher used the algorithm to carry out the manual computation of the optimization process and also used C sharp programming language to create a code that is able to minimize the total distance of the network. In this dissertation the prim's algorithm has been translated into a simple model that can be easily used to map distances between nodes and vertices. The model presented in this dissertation help network service providers such as electricity, telephone and information technology to optimize their network resources so as to save money and resources for other uses in the future

II. METHODOLOGY

In this project, 12 nodes are connected to each other using the links present in below fig 1. Nodes are powered through the 2 power supply that are represented by the 'A' and 'B'. If the one link failed due to some natural or man-made crisis, then this system is designed to recover the failed node which is connected to the failed link. Such that cost of developed spanning tree should have the minimum cost when prims is calculated.

If the N2 failed, then node connected to that node to downward also fails due to no electricity reached to that node not because of the link fails.

That should take into account to effectively recover the failed node. So that systematically gone through the prim's algorithm that calculate the system failure recovery capability that could enhance through this technique.

There are three kinds of the link that are present in the simulation of this project. First that connected between 'A' and 'B' power supply. This link does not take into account while calculating a minimum spanning tree, but it acts as an important point to be considered while designing the efficient grid healing system. Because of that link fail node able to reconnect to the working node system even after failing repeatedly.

The Second type of link that are shown in figure using plane line this type of link are having more weight that virtual node. That can connect after the connect after connecting virtual link.

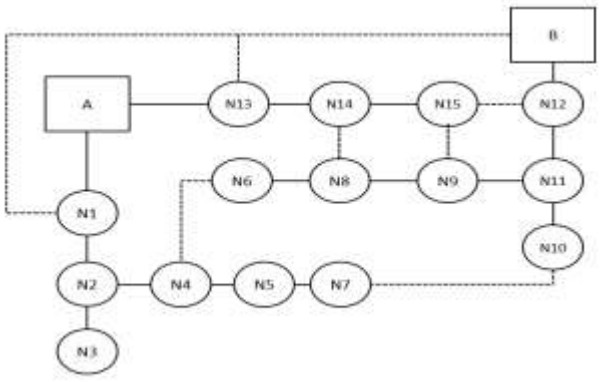
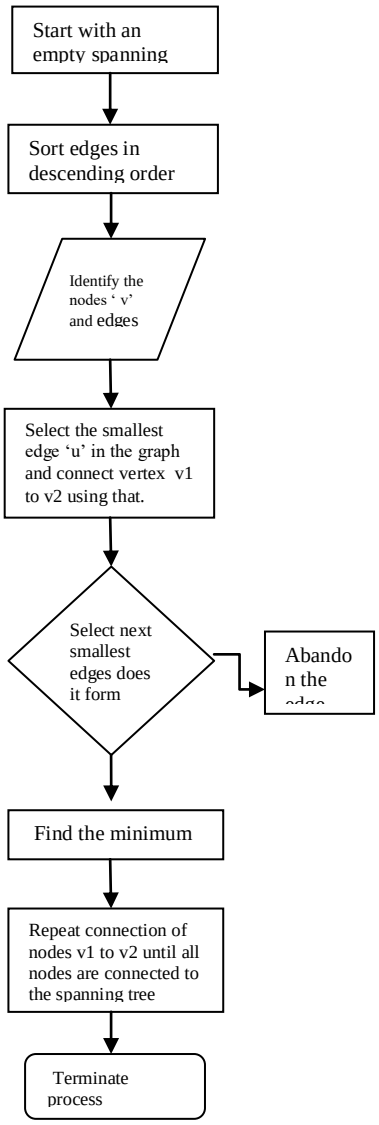


Fig. 1 system architecture of smart griding.

The third type of link is shown using a dashed line having more weight than the other two link type. In the case of link failure this link connected in the last case because of its high cost. In this paper all the operations like add new link, delete the link, the Appling prims algorithm is going to perform and all the actual hardware implementation is performed on that system and capture its output in the simulation section.

A) Prims algorithm



Methodology prim's algorithm has been applied in creating a model of an optimized grid network. This model forms a spanning tree which is a sub graph that is a tree and spans out to reach all the vertices of the original graph. Vertices to be reached by the tree include schools, clinics and substations. Computation of the graph was done using Visual Studio C-Sharp programming to create a minimum spanning tree program that is capable of establishing an optimized network grid. prim's algorithm processes the edges of a network in order of their weight values from smallest to largest, for the MST contraction each edge that does not form a cycle with edges previously added is considered for the network .

The prim's algorithm makes heavy use of set operations "find" and "union". Optimally implemented, the "find" and "union" operations on sets grow very slowly with the number of elements in the disjoint sets. Algorithm Let (v) = vertices or nodes in the network (u) =edges in the network (s) = set for spanning tree containing edges (u) and nodes (v) • Start with an empty set, S, and select at every stage the shortest edge that has not been chosen or rejected, regardless of where this edge is situated in the graph. • Select edge (u) with the least weight (w) and connect it to node (v) • Repeat stage 2 until all edges are connected to the network • Set S will ultimately contain the edges of the MST for each (u, v) taken from the sorted list o do if FIND-SET (u) = FIND-SET (v) o then S ← S ∪ {(u, v)} o UNION (u, v) .

B) SYSTEM ALGORITHM

1. Initialize the system
2. Sort the weight point for each connection.
3. Identify the nodes and edges and Calculate the minimum spanning tree for given network using prims algorithm.
4. After getting result control the switch as per the connection of the minimum spanning tree.
5. Select smallest edge in the graph and connect the vertex.
6. When the failure occurs check that on which node failure occurs by using checking the change in matrix input
7. Recalculate the minimum spanning tree for network considering the failed node
8. Get the result from the minimum spanning tree 3algorithm and recheck or connect the failed node to appropriate node for recovery of the failed node
9. Repeat process till the system is going to working condition
10. Finish.

C) SIMULATION

For the simulation purpose of this technique python has been used to implement code for this fig. 1 architecture. So that it could recovery every possible failure in the fig. 1 architecture. In this project we used prim's algorithm which proved the algorithm can optimize a network to produce the least possible total distance network.

Methodology shows the whole work of our project. First, we find the required analysis for our project. After finding all the components, then main part is designed.. Because in design the silly mistakes also will not be considered. After the finding the errors and correcting them our design is ready. After designing part testing is done. And our final project is ready the steps are shown in below.

Required analysis: In this system we required some hardware and software requirements. The hardware required for this project are PIC18f4520, Microchip PIC18F4520,Fault switches, Resistors, USB-TTL Module, Reset switch, LCD 16x2 Keypad,ULN2003X2 Relay driver, Relays, LED 5mm,Power supply. And the software required are MATLAB 2013a, MPLAB X IDE, DIP Trace, Proteus, Comport driver. Design:-This system requires prim's algorithm .so in this process first we design prim's algorithm to find minimum spanning tree. After that we switch over to the circuit. Implementation:- Using matlab software we can implement the system.

Testing:- In this system each node is connected to their default power supply section. In the normal condition every user node working fine with the supply given by their power supply And each switch is at their default position to provide the electricity from their power supply distribution center. And each sensor of node fail gives the default 'zero' value. In the case of the node failure

respective sensor node goes high and controller system get into active mode.

This is the simulation of power supply for the AID kit. The basic step in the designing of any system is to design the power supply required for that system. The steps involved in the designing of the power supply are as follows, 1) Determine the total current that the system sinks from the supply.2) Determine the voltage rating required for the different component.

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III. RESULTS

This conclude that using prims algorithm in the now-a-days running electricity grid system can improve the overall efficiency of the gridding algorithm in which each node can heal itself using an online algorithmic system that uses the prims minimum spanning tree algorithm for improvement of the electricity grid system. In this project we used prim's algorithm which proved the algorithm can optimize a network to produce the least possible total distance of a network. The main goals achieved in this project can be summarized as Reduction of resources used when constructing a network grid Establishment of routes with the least possible cost. It has enabled construction a computer program for the optimization of the network.

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