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SIMULATION OF MULTIAGENT BASED DISTRIBUTION AUTOMATION SOLUTION FOR SELF-HEALING GRIDS USING PRIM'S ALGORITHM

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ABSTRACT

Self-healing is the important aspect of the nature in which any system recovers it to the normal level whenever the fault or breakdown occurs. Whenever Electricity is taken into account, then also self-healing of this system should take into consideration. Self-healing is one of the significant features of the smart power system. A self-healing power grid can identify and react to the fault and restore power system with or even no human intervention [2].

We have experienced the blackout because of the electricity power system failure that causes the economic, social life of the people. In the developing country like India, Pakistan, Bangladesh even in the America, there is always been a problem of grid failing because of the accident like a car smash into an electricity pole, load shading and natural calamities like tornado, threatening rain, lightening. In this situation the industrial and residential area is most affected by the grid failure [3].

KEY WORDS: Python, Prim's Algorithm, Vertices, Edges, Smart Grid System, Self-healing grids.

INTRODUCTION

Self-healing is a prominent characteristic of smart grid. Self-healing technique is the important guarantee to implement the smart grid, also is the support of achieving the secure operation. Through searching many domestic and foreign self-healing control techniques. To handle such situation some practices had been taken into account to prevent or minimize the effect of the grid failing. So for that in this paper one system algorithm going to develop for the overcome the problem of the grid failing. The basic principle is to redistribute the power flow of a contingency transmission line to other lines with flow control relay. To implement the control strategy, the Minimum spanning tree network and Prim's analysis method [1], instead of the iteration algorithm and optimization method, is applied to redistribute the power flow [4].

Basically the prim'salgorithm is a greedy algorithm that finds a minimum spanning tree for a weighted undirected graph .This means it finds a subset of the edges that forms a tree includes every vertex, where the total weight of all the edges in the tree is minimized. The algorithm operates by building this tree one vertex at a time, from an arbitrary starting vertex, at each step adding the cheapest possible connection from the tree to another vertex.

BLOCK DIAGRAM

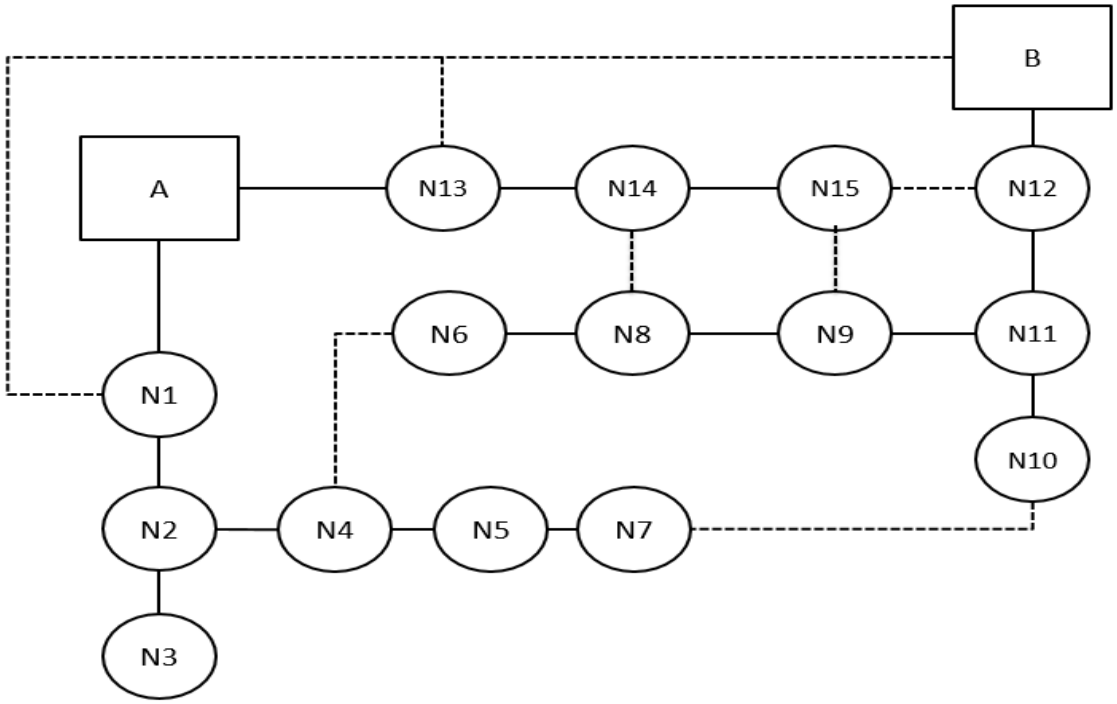


Fig. 1. Block diagram of the automatic grid healing system

WORKING

In this simulation, 15 nodes are connected to each other using the links present in the figure.1. Nodes are powered through the 2 power supply that is represented by the 'A' and 'B' in the figure. If anyone link failed due to some natural or man-madecrisis, 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 prim's is calculated. If the N2 in the given figure is 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 calculates the system failure recovery capability that could enhance through these techniques.

There are three kinds of the link that is 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 than virtual node. That can connect after connecting the virtual link. The third type of the link showed 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 prim's algorithm is going to perform only on above figure and all the actual simulations are performed on that system and capture its output in the simulation section. While considering the grid algorithm always link between power supplies should have minimum cost and always present while performing the prim's spanning tree algorithm for efficient algorithm having a less error and high ability to recover itself.

FLOWCHART

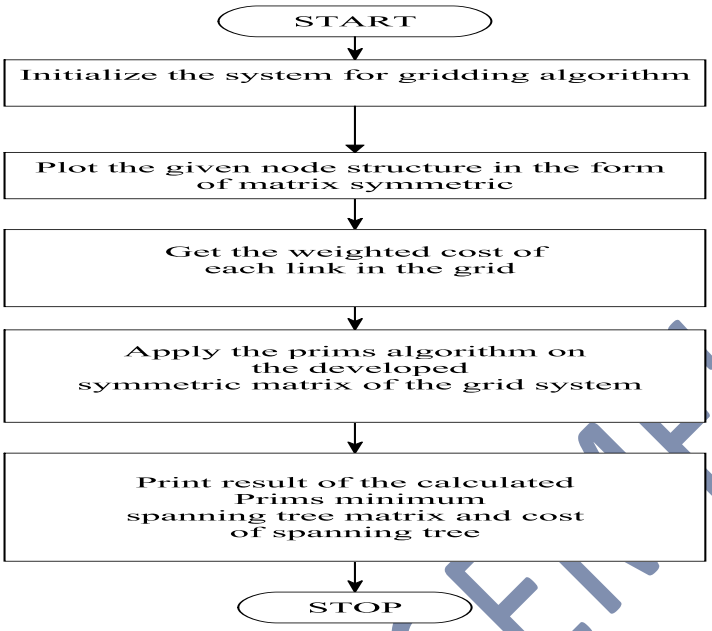


Fig.2.Flowchart of the System work

ALGORITHM

1. Initialize the system.
2. Plot the graph of the physical grid system and the weight point for each connection.
3. Gets the matrix connection statusfrom the grid architecture using the developed symmetric matrix for calculating minimum spanning tree.
4. Calculate the Minimum spanning tree for given network using a prim's algorithm.
5. After getting result control the switch as per the connection of the minimum spanning tree.
6. Get the matrix status for checking for the failure of the node occurs or not.
7. When the failure occurs check that on which node failure occurs by using checking the change in matrix input.
8. Recalculate the minimum spanning tree for the network considering the failed node.
9. Get the result from the minimum spanning tree algorithm and recheck or connect the failed node to the appropriate node for recovery of the failed node.
10. Repeat process till the system is going to working condition.
11. Finish.

SIMULATION RESULTS

For the simulation purpose of this technique python has been used to implement code for the figure architecture. So that it could recover every possible failure in the architecture. Simulation result is carried out by PYTHON 2.7.9.

A. SHOW ALL LINKS IN THE GRID SYSTEMS

In this section we can see the available link in a grid system to apply the prim's algorithmof the present system. So that the entire link could which are present in a system that can process through the prim'salgorithm. It shows the all present links in the grid that can use as the path for electricity distribution.
Example shown below is of link in grid system;
('A','N13', '2','b')
Here 'A' and 'N13' show end node that connected with above link &'2' denote cost for using this link in grid system. And 'b'is the system denoted name for the respective link.

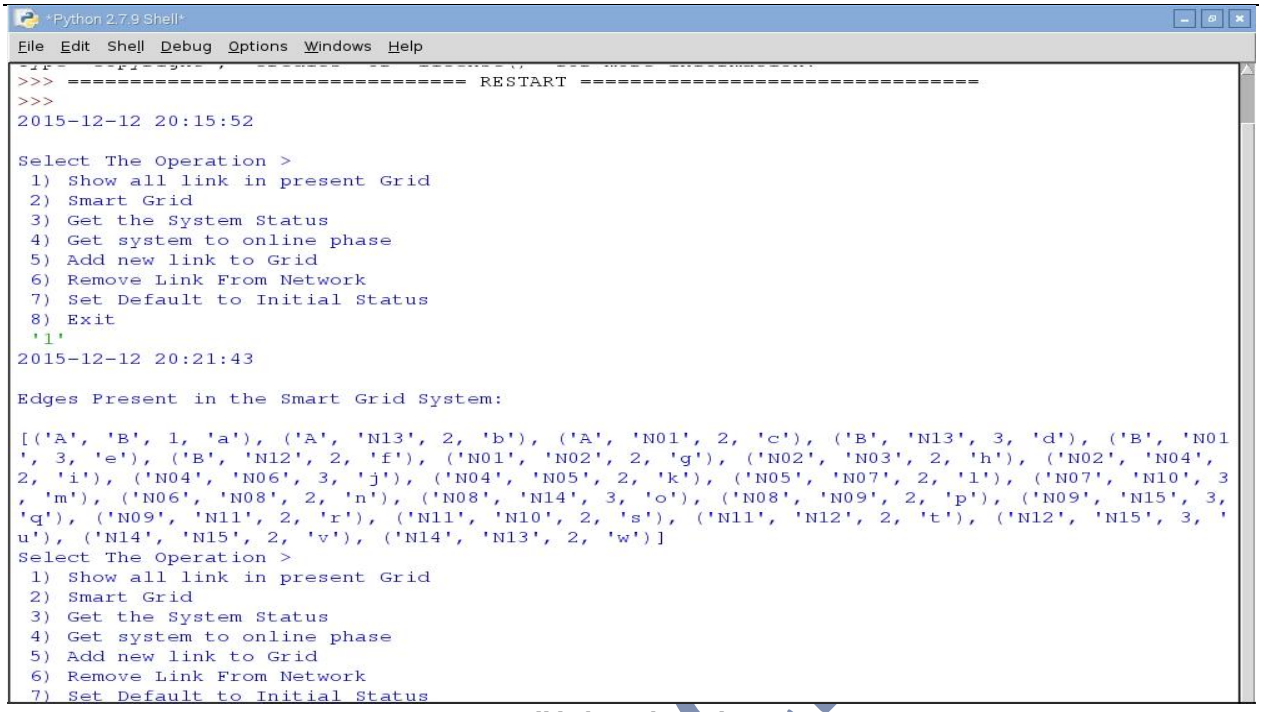
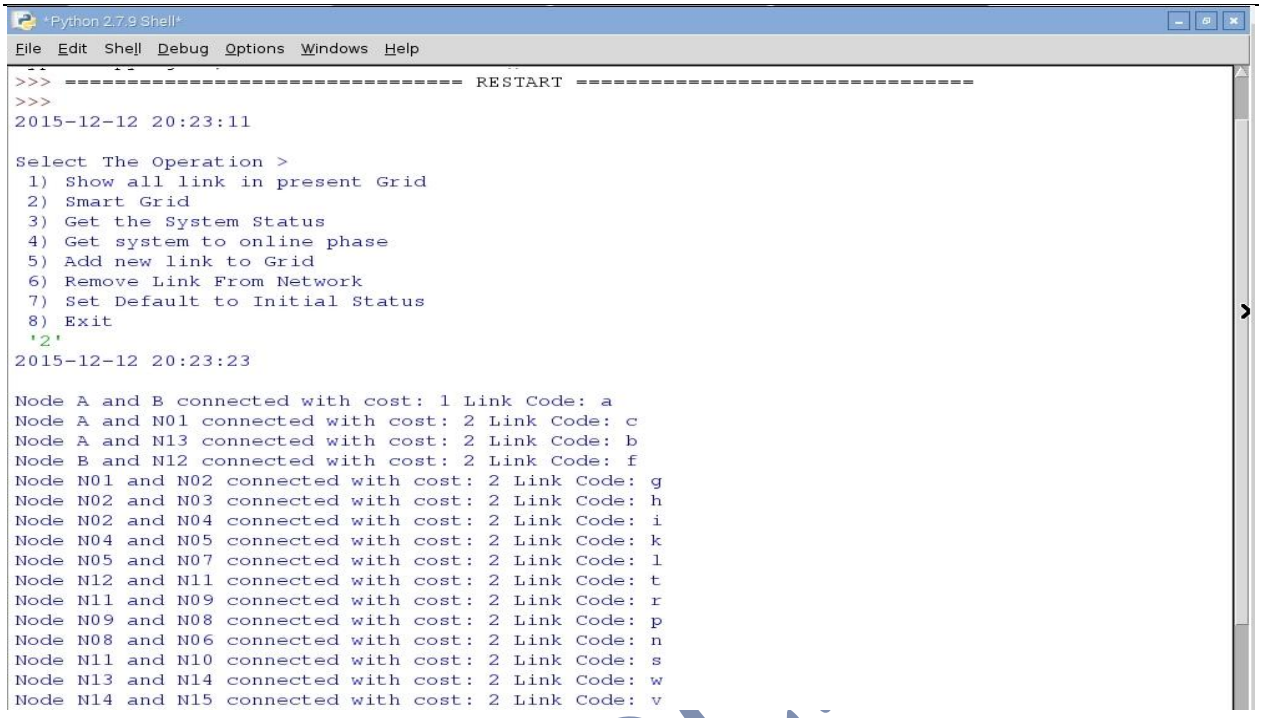


Fig.3.All links in the grid system

B. SMART GRID

In this section we formulate the prim's algorithm in the python code using python 2.7.9.Using prim's code we can find out the minimum spanning tree cost for given system having two power supply and 15 user node that can connected through link provided on the basis of the link cost between the system.



C. ADD NEW LINK TO THE GRID

In this section we add the new vertices in the grid system that are going connected through the process while execution of the prim's algorithm. If then there is a chance of adding new links into the grid because of the some natural or man-made issues that could result into adding new link into system that can cause the increase the redundancy in the system We can add the link in the system easily and add the parameter into the system to calculate and reformulate the new spanning tree for the system.

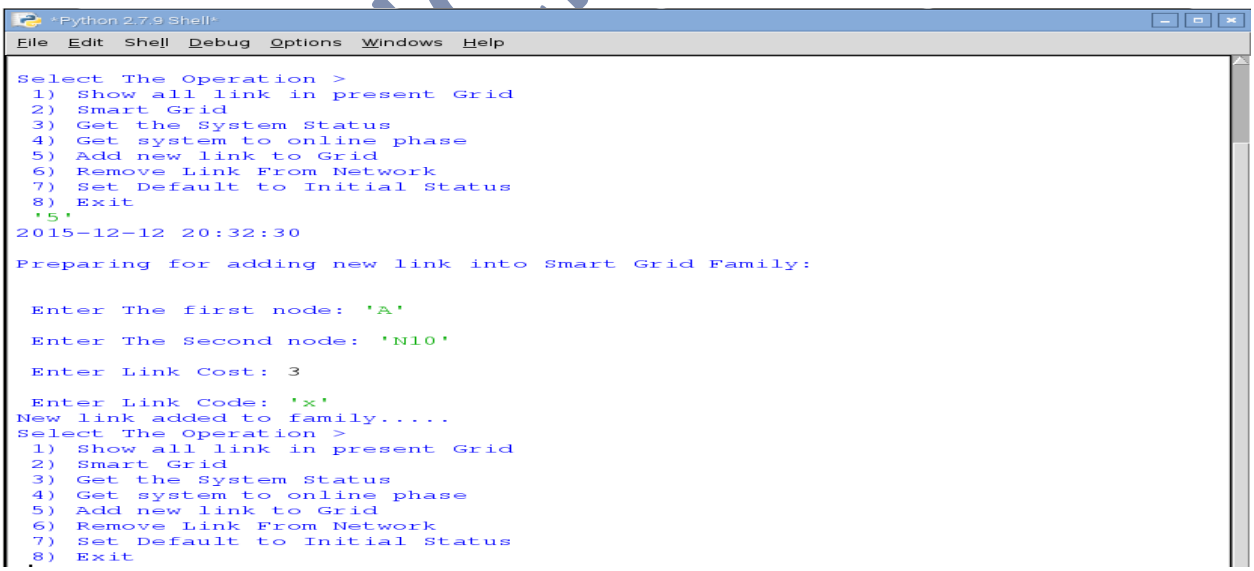


Fig.4.Add new link to the grid

D. REMOVE THE LINK FROM THE GRID

In this section we can remove the vertex parameter that is physically unavailable or not present in the simulation we can neglect that vertex from code execution. By the chance there is also the probability of the system to remove the existing link from the grid system because of frequent failure in that link that could result into decrease the efficiency of the system. So that we can remove an existing system link and recalculate the prim's cost.

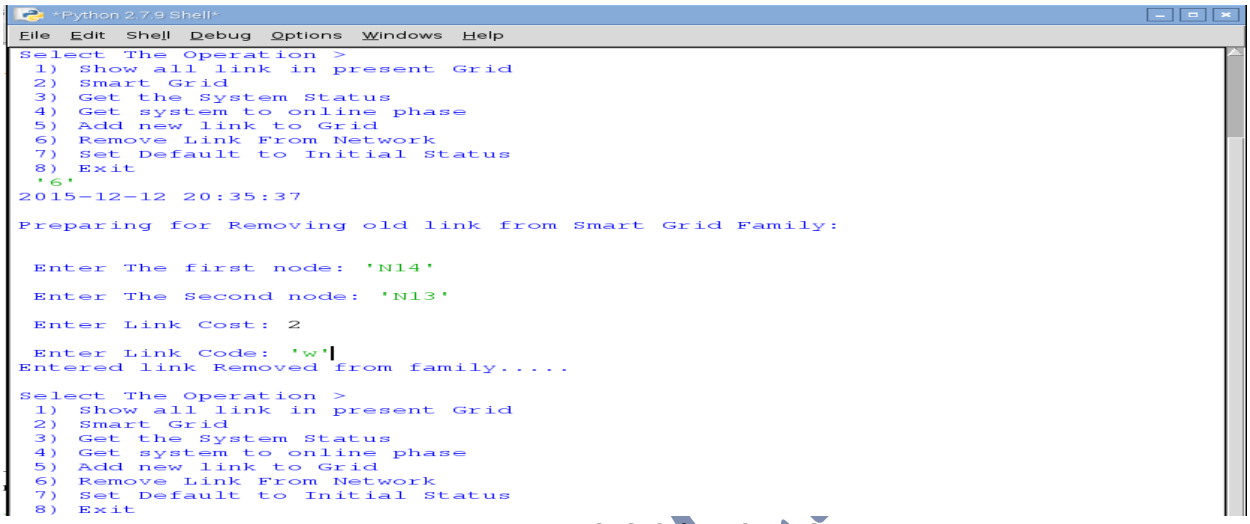


Fig.5.Remove the link from the grid

CONCLUSION

This simulation concludes that using the prim's algorithm in the now-a-days running electricity grid system can improve the overall efficiency of the system by easily adding new links to the grid or by removing the link from the grid.

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