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APPLICATION OF MULTIAGENT AGENT SYSTEM FOR SELF HEALING SMART GRID, USING PYTHON

Mr.Mohit HaridasTapase
Student, Department of Electronics and Telecommunication,
D.Y.Patil College of Engineering& Technology, Shivaji University, Kolhapur, India
mhtapase@gmail.com

Prof.Ajitsinh N. Jadhav
Professor & Head, Department of Electronics and Telecommunication,
D.Y.Patil College of Engineering& Technology, Shivaji University, Kolhapur, India
ajitsinhj33@gmail.com

Abstract

A lot of work has been done to implement self healing property to smart grids. The principle behind self healing smart grid is analogy of the human body. Now a day's electrical grid is going more complex and dynamic in nature. The term dynamic, it means that system is unsecured, unreliable with continuous varying load and no quality power is provided to end customers. This calls for a new generation technology in power world. One of them is "Smart Grid with self healing property". The smart grid comes with the tag of more simplified architecture, to handle continuously varying load and ever increasing power demand. The smart grid also needs a very efficient and automated monitoring systems. In this paper author has tried to present a self healing property of smart grid systems using the multi agent base approach for continuously monitoring bus data. The software used, to implement this is a python. Python offers a very high advantages as compared to other competitive software's (e.g. C, C++ & MMATLAB etc.). Some of them are highly efficient, simpler etc. Concept of agent is derived from the, experts in particular system. Here agents do sophisticated monitoring of all the bus data. The data acquire by the monitoring system are very much helpful in making decisions and give commands to various control devices using supervisory control and data acquisition(SCADA) system.

Key words: Self-healing grids. Software python, Vertices, Prim's Algorithm, Edges, Smart Grid System, power system stability/reliability.

Introduction:

Day's are coming where, restructuring of electrical grids will be done at a faster rate. There mainly two reasons. 1. Demand of electricity consumption is increasing day by day. 2. Deregulated markets generated competition against the electricity distributor for quality power. In India there is no much choice to choose a distributor as on today, except some metropolitan cities like Mumbai and Delhi. Considering above reasons every distribution authority is focused not only on the continuous availability of the power, but also they are working on quality & reliability of the power network [1]. To meet the requirement of customers and to keep company more competitive in the vulnerable electricity market, the need for a smart grid arises with self-healing properly arises. In this paper author has tried to develop a program using python software to adopt self healing property in the system using prims algorithm.

Block Diagram

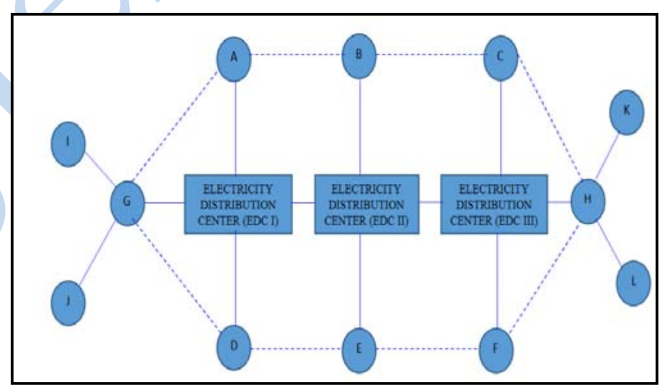

Fig. 1.Block diagram of self healing architecture of smart grid

Working

The system is implemented for three different energy sources named as Electricity distribution centre I,II& III. Three sources are taken in consideration for improving stability of the system. The advantages of having more than one electricity distribution centre are redundancy are well maintained and failure will not result in loss of load or revenue to any distribution authority.

Prim's Algorithm is mostly used in computer science and it is greedy algorithm. The prime use of using a prim's algorithm is to find a minimum spanning tree for a weighted undirected graph. This simply means that it used to find a subset of the edges, which forms a tree that includes every vertex. The total weight of the all the edges in the tree is minimized by using this method. The prim's algorithm is mainly used when the graph is having many edges. In case of power system, the prim's algorithm can be used to circuit having many nodes.

Advantages of implemented System

1. Distribution of electricity will be smoother, due to faster decision making in case of a crisis situation.
2. The prim's algorithm to find a minimum spanning tree, is more than any other greedy algorithm.
3. The time required for computation using a prim's algorithm is very less, as compared to other system.

Prim's Algorithm:

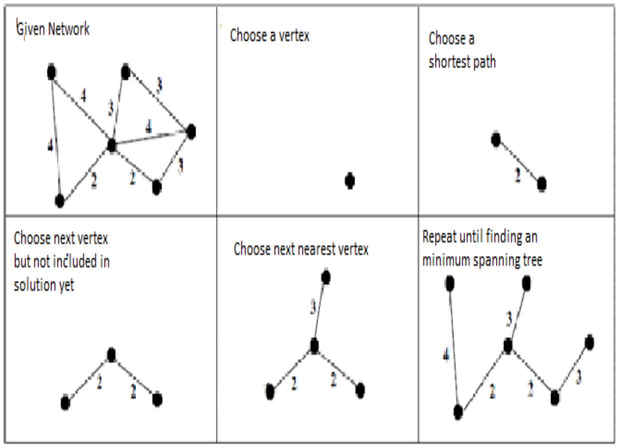

Fig. 2. Structure of a prim's algorithm

Flowchart

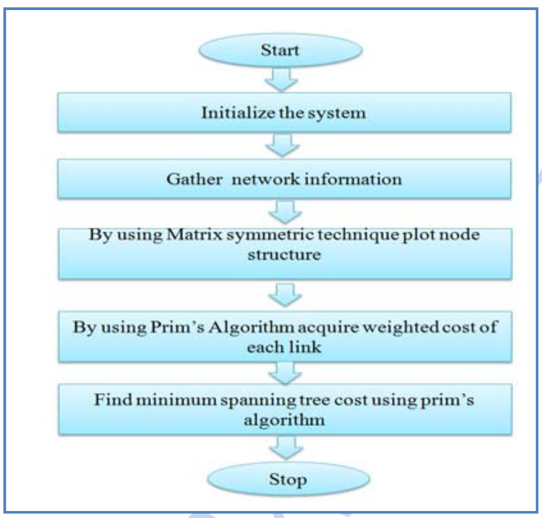

Fig.3. Flow chart for sequence of operation

Simulation Results

Simulation of proposed system is ben done by using a python software to implement code for the architecture proposed in fig.1. The python program is written in such a manner that it should check every possibility of failure of architecture.Simulation result is carried out by PYTHON 2.7.10.

CASE A: Show all links present in the Grid

In case of 0 link cost between power supply for the minimizing the prim's calculating cost in program that cannot effect minimum spanning tree cost.

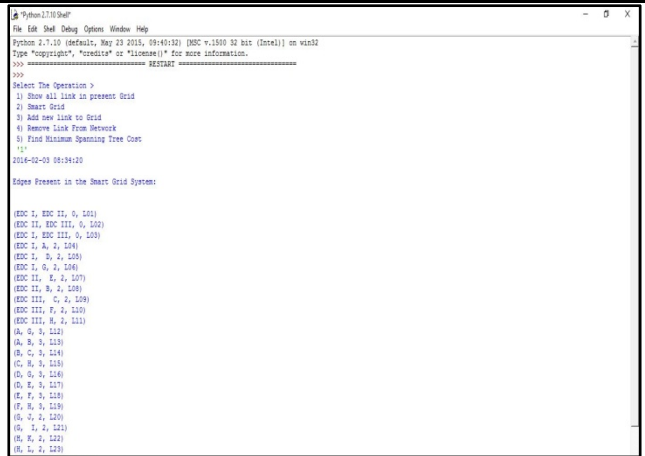

Fig. 4. Show all links present in the Grid

CASE B: Smart Grid

In this section we formulate the prim's algorithm in the python code using python 2.7.10.Using prim's code we can find out the minimum spanning tree cost for giving system having two power supply and 12 user node that can connect through link provided on the basis of the link cost between the system.

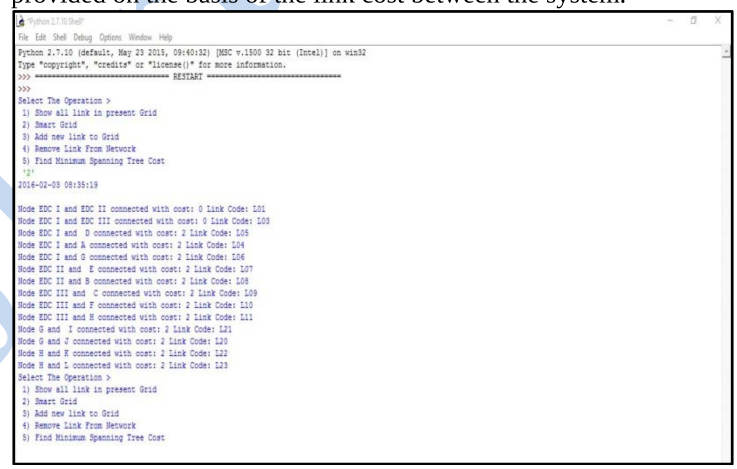

Fig.5. Smart Grid

CASE C: Add new link to the Grid

If there is a chance of adding a new link into the grid because of the some natural or manmade 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.

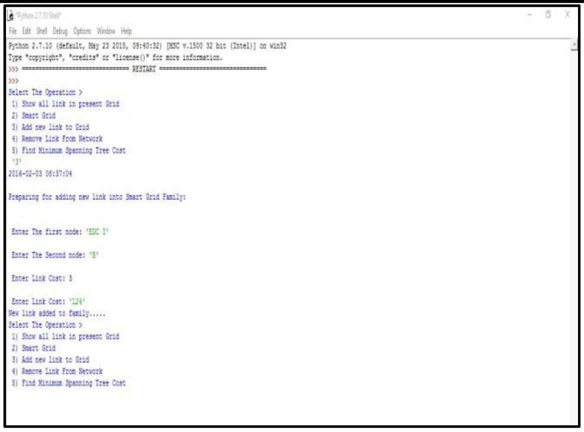

Fig.6. Add new link to the Grid

CASE D: Remove the link from the Grid

By the chance there is also a possibility 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.

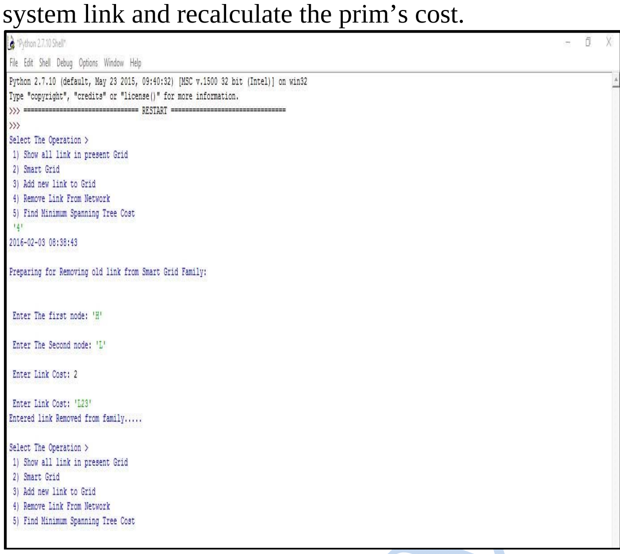

Fig.7. Remove the link from the Grid

CASE E: Find Minimum Spanning Tree Cost.

In this case we just get to know the total prim’s cost for the get the knowledge of prim’s algorithm efficiency.

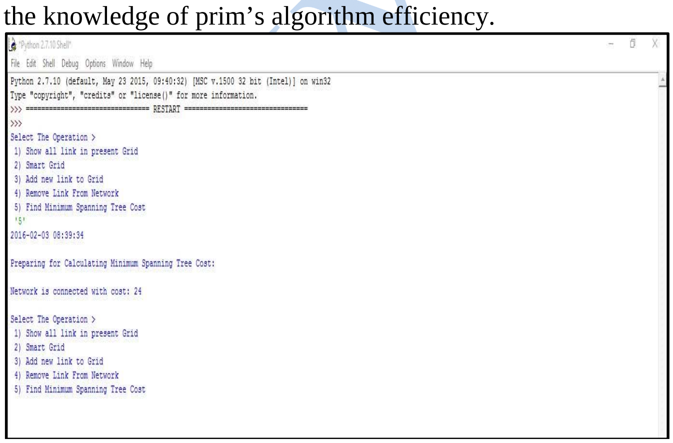

Fig.8. Find Minimum Spanning Tree Cost.

Conclusion:

The system implemented is proposed architecture for self healing smart grid system, using minimum spanning tree cost of the prims algorithm. The advantages of prim’s algorithm is used to implement self healing property of smart grid. By finding a minimum spanning tree cost the smart grids will be less vulnerable to faults and efficiency of the system can be maximized by reducing the outages and by doing a proper contingency analysis. By implementation of the proposed system we can find the which link to be removed for satisfactory operation of the distribution network.

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