

# A REVIEW OF SELF HEALING SMART GRIDS USING THE MULTIAGENT SYSTEM

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## ABSTRACT

This paper is trying review different techniques used for self healing of the smart grid network. A smart grid has taken a very high importance in the last ten years or so. Then the advancement in smart grid has taken a major importance. One of the most important aspects in the field of smart grid is a self healing of fault, and this attracted the researchers. As described in many research papers, one of the main requirements of the electrical grid is to maintain zero gap between generation and distribution [2, 3, 4]. However deregulation and decentralized generation has given with the information and communication technology (ICT). This paper will summarize latest available techniques for self healing smart grids.

**KEY WORDS:** Self healing system, Smart Grids, Information and communication technology (ICT), fault location isolation and restoration service.

## INTRODUCTION

As a customer everyone needs a quality and reliable service this is applicable to electric power as well, and this fact keeps distribution system operation (DSO's) under pressure. Moreover, as seen in the last decade, deregulated electricity market has put more pressure for continuing quality and reliance power for each player in the market. In short, in the smart grids are considered to be totally internet control network, generation, transmission and distribution. Every step in electrical network can be monitored with the help of internet network or it is also called as information and communication technology.

Internet services/cyber services in smart grids are mainly used for following purpose

1. Integration of renewable energy sources with grid at ease
2. Allow secure and reliable power and information flow from both ends
3. Enabling energy efficiency services, appropriate demand management to minimize losses

4. The system should be acquainted with the self healing power of disturbing events
5. The provided cyber systems should not be hack able.

## LITERATURE REVIEW

### Multiagent-Based Distribution Automation Solution for Self-Healing Grids

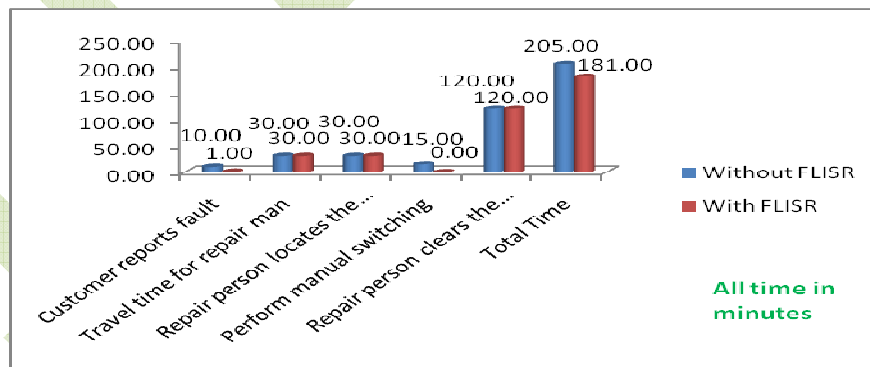
Markus Eriksson, Mikel Armendariz, Student Member, IEEE, Oleg O. Vasilenko, Arshad Saleem, Member, IEEE, and Lars Nordström, Senior Member, IEEE.

According to this paper, electricity sector is demanding distribution system operators (DSO) to improve the performance of the electricity network on various parameters like reliability and quality of the supply. Customers are aware of what is power quality now, which puts a pressure on distribution authority. To fulfill this demands renovation of the existing distribution system is necessary and accomplish tasks we need to take an advantage of computer system. One of the most advance and affordable system is information and communication technologies (ICT). The main function of the ICT will make a system administrator, aware of the situation. The system owner has to take care of new laws and operational paradigm and different models available in the market.

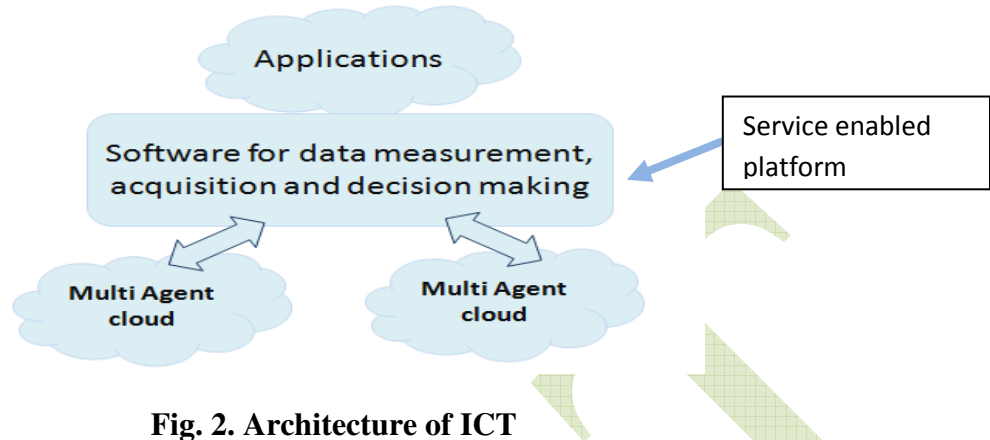
In this paper distribution automation FLISR solution is based on a technique called MAS. This technique is based on a three agent types that are,

1. Substation control agent (SCA)
2. Load control agent (LCA)
3. Restoration agent (RA)

All above mentioned types does both functions of controlling and protection, and protection and control is compatible with IEEE standard IEEE-61850. In this paper proposed solution uses a distributed implementation of PRIM's minimum spanning tree algorithm to advise a solution on a restored part of the FLISR network.



**Fig. 1. Breakdown time estimation with & without FLISR**



**Fig. 2. Architecture of ICT**

Fig 1. Gives an detail time outage for without FLISR network and with FLISR network. In fig.2 architecture of ICT is presented. In this service enabled platform serves as a mediator between application and multi agent cloud.

In short this paper is trying to emphasize on automation and control in distribution system. This paper used an PRIM's minimum spanning tree algorithm & parallel ICT system in conjunction with MAS in smart grids.

### **A Cooperative Agent-Based Architecture for Self-Healing Distributed Power Systems**

Aboelsood Zidan, E. F. El-Saadany, L. El Chaar.

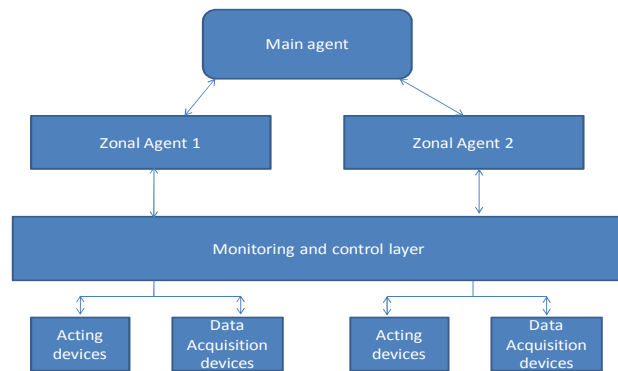
This paper is written keeping mind, the customer is important and loss of electricity supply is loss of revenue. After fault restoring the equipment is one of the greatest challenges in the distribution network, because of the network spread over a large area and many tapings are provided [4]. Service restoration is defined as finding a suitable backup feeder and laterals to transfer the loads in out-of-service areas using operational criteria through a series of switching operations [5]. The structure of the proposed system in this paper, is comprised of four different agents.

**1. Bus Agent (BAG):** The role of BAG is to monitor all parameters associated, each bus has own BAG. It is designed to control the operation on both sides of the bus. The major role of BAG is also to notify the zone agent (ZAG) for any abnormal operation.

**2. DG Agent (DGA):** Here DGA refers to a diesel generator. If DG is included the reliability of power can be promised to the customer.

**3. Zone Agent (ZAG):** For each zone is dedicated and it responsibility is to initiate primarily restoration with its neighboring ZAG. ZAG has to do communication with BAG and minimize the outage.

**4. Global Agent (GAG):** The most important stage in the proposed configuration is GAG. It provides a local optimum solution at initial stage and it is par with the global optimal solution.



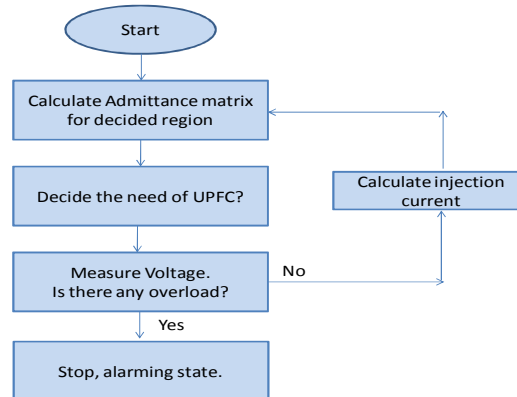
**Fig. 3. Proposed Architecture of the implemented system**

In this architecture, a two stage method of distribution for restoration of a supply is presented, using the multi agent system. Multi agent system is implemented to adopt most important property of smart grid i.e. self healing. As a system operator we need to focus on the first stage of operation and primary load, for that cooperative control architecture has been proposed. Second stage implementation in this paper is considered as a future work [6,7]

**Wide area measurement/wide area information-based control strategy to fast relieve overloads in a self-healing power grid**

Zaibin Jiao, Kun Men, and Jin Zhong

This paper shows a very effective technique for overload in smart grid and the self healing algorithm is implemented for IEEE 39 bus test system.



**Fig. 4. Algorithm for overload protection of self healing network.**

Overload is the most dangerous cause in the power system network. Overload may or may not cause instability of power system network, many researchers are working on this. However, if overload is for longer time it may cause a cascading tripping and it may result in blackouts. So,

special attention should be given while designing a self healing smart grid network [8,9]. The proposed system uses a unified power flow controller (UPFC) to relieve an overload in power system network, and to avoid the consequences of overloading. The proposed strategy uses an advance methodology of wide area measurements are taken and fed to an online algorithm, to decide an injection current of UPFC. This method is considered as advance for two basic reasons, this method doesn't require long and tedious process of iteration and optimization of the solution. Another advantage of using this method is, the admittance matrix is calculated for only area under supervision, it helps reducing a computational burden and speed decision making.

## CONCLUSION AND FUTURE WORK

The above three papers gives a self healing property of smart grids, and how we can restore the network in case of emergency. Different approaches have been dealt here, but the core of all objects is multi agent base. To implement this system the help of cyber network is very important for setting up an information and communication network (ICT). All the techniques presented above give a very important aspect of reduction of outage time. The third technique presented in the system gives a very interesting technique for overload detection and cancellation using a unified power flow controller (UPFC). Author is also trying to comment on the hacking of electrical network will be also possible if implementation of ICT takes place, this is one worry point every researchers have to look for. In brief self healing, multi agent base system is designed to improve reliability of electrical networks and improve customer satisfaction.

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