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A Review Paper on Voltage Quality of Smart Grid System

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***Abstract*—Low quality of electric power is typically caused by control line unsettling influences, for example, driving forces, scores, glitches, passing intrusion wave issues, voltage list, swell, consonant twisting and glimmer bringing about disoperation or disappointment of end utilize supplies. The power quality unsettling influences from the perspective of matrix viewpoints and also clients. It depicts the structure of cutting edge control system. It displays the fundamental thoughts of energy quality unsettling influences. In the earth of the present keen lattice situation consideration of sustainable power sources, control electronic gadgets, organized sensors and computerized controls causes voltage list and swell which influences control quality. This work proposes another technique for droop and swell discovery in view of wavelet change and its rebuilding. In this work we will attempt to lessen the past issue of the voltage and endeavour to enhance the voltage nature of the power system. In this paper we present the a study on Voltage Quality of Smart Grid System**

Keywords: Power System, DWT, Smart Grid, Voltage, Loss.

I. INTRODUCTION

In recent years, grid users have detected an increasing number of drawbacks caused by electric power quality (PQ) variations and PQ problems have sharpened because of the increased number of loads sensitive to PQ and have become more difficult to solve as the loads themselves have become important causes of degradation of quality [3]. The power system fault has become common due to increased congestion on the network, integration of RE sources with grid and use of nonlinear power electronic devices in the network. With the wide application of high power electronics switchgears, problems of power quality are becoming more serious day by day [4]-[5]. The power quality disturbances depend on amplitude or frequency or on both frequency and amplitude. Based on duration of existence of PQ disturbances, events can be divided in short, medium or long type. The classification and identification of each disturbance are usually carried out from standards and recommendations depending on where the utilities operate. The end customer related PQ issues widely reported in literature, there is need to investigate in to the impact of PQ disturbances on the performance of the utility network and develop a new cost effective technique for the minimization of effect of PQ disturbances on the end use equipments as well as the equipments installed in the power network.

1.1 Power Grid:

Power matrix has made spearheading strides in conveying Smart Grid innovation to all features of energy supply esteem chain and created brilliant network pilot extend at Pondicherry through open cooperation covering all properties of shrewd lattice in distribution. Indian mammoth power framework is confronting the different issues. Because of these issues, the development of power showcase is moderate. The present lattice framework in this nation is unfit to deal with these inconsistencies. To deal with these inconsistencies and other common obstacles in control framework, there is a need to finish robotization. Review these issue keen Grid advances is to be present/installed in control arrangement of our nation. In nowadays Smart Grid is the panacea of the greater part of the issues in the power framework. The keen lattice will check and destroy the different bottlenecks and disparities in the present

control lattice framework. The Indian power lattices are not secure, dependable and up to the check. To diminish these lacks, the innovation of "Keen Grid" is required. The Smart Grid can be made by propel innovation, instruments and clever administration framework .Smart Grid is a fundamental reaction to the natural, social, and political requests, set on vitality supply. The savvy control matrix turns out to be significantly more mind boggling than a customary power network as time-changing wellsprings of vitality and new unique burdens are incorporated into it. The savvy framework's multifaceted nature will advance after some time and require new innovations for effective, dependable and secure operation and control as the interest for power increments. The motivation behind Smart Grid is to recognize and redress supply request awkwardness immediately and distinguish blames through a self-recuperating" process that enhances administrations quality, effectiveness, improves unwavering quality and

diminishes costs . With the propelled advancements, the shrewd electric power lattice will be secure, solid and bi-directional. The Smart Grid will be giving environmentally friendly power vitality, superb supply of energy and incorporation of sustainable power source assets.

1.2 Power Quality

The term power quality (PQ) is generally applied to a wide variety of electromagnetic phenomena occurring within a power system network. Power quality is predominantly a customer issue. Power quality can be defined as any problem manifested in voltage, current, or frequency deviation that results in failure or mal-operation of electric equipment [6]. The electric power quality is also defined as a term that refers to maintaining the near sinusoidal waveform of power system bus voltages and currents at rated magnitude and frequency. Thus electric power quality is often used to express voltage quality, current quality, reliability of service, quality of power supply etc. [7]. Power quality issue is also important for the utility companies. They are obliged to supply consumers with electrical power of acceptable quality.

The application of WT has become a popular for some time under the various names of multirate-sampling (Quadrature Mirror Filters) QMF in electrical engineering (Sarkar et al., 1998). WT possesses many desirable properties that are useful in engineering, economics and finance. The ability of wavelet analysis deals with both the stationary and non-stationary data, their localization in time and the decomposing and analyzing the punctuation in variable signal. While a review of the possible future contributions of WT is provided to the engineering discipline, there are explored two ways in which wavelets might be used to enhance the empirical toolkit of our profession in engineering (Crowley, 2005). These are summarized in the following: Time scale versus frequency: An examination of data sets to assess the presence and ebb and the flow of frequency components is potentially valuable (Crowley, 2005). Time scale decomposition: Recognition components of the signal can be possibly found at disaggregate (scale) level rather than an aggregate level forecasting: disaggregate forecasting, establishing global versus local aspects of series (Crowley, 2005).

1.3 Modern Power System

The electrical power system used to transfer electrical power generated at central generating stations to the customers situated at remote locations far away from the generating stations. Transmission lines in the power system are an interface between the generating stations and distribution systems [8]. It provides the path to transfer electrical power from central generating stations to load centers [9]. The analysis of electromagnetic transients arising in EHV/UHV power networks gives necessary information about the possible stresses on the different network components, which will determine their proper design and limits of operation [10]. The modern power network has integrated distributed energy sources such as wind and solar energy. It has several micro-grids integrated with the network which are operated in grid connected mode and grid isolated mode. The communication system used to transfer signals for protection system of the network is a part of the system. The nonlinear power electronics converters used to integrate the RE sources with grid are part of the modern day power system. Large number of power system equipments such as transformer, CT, PT, CB, generator, and other 4 | P a g e control equipments are also the part of modern power system. The different types of linear and nonlinear loads are also the part of this system. Due to the recent growing emphasis on environmental issues in many countries, modern distribution networks are rapidly evolving toward the new concept of smart grid with an increasing level of penetration of distributed generation (DG) units, storage systems and information and communication technologies. Depending on the characteristic of the grid supply voltage, the current distribution systems can be classified as hybrid AC/DC system. DG incorporates a wide range of prime mover technologies, such as internal combustion (IC) engines, gas turbines, micro turbines, photovoltaic (PV) systems, fuel cells, wind power and AC storage. Most emerging technologies such as micro turbines, photovoltaic systems, fuel cells and AC storage have an inverter to interface with the electrical distribution system. These emerging technologies have lower emissions and are becoming cost effective with the passage of time. Using DG in the distribution system reduces the physical and electrical distance between generation and load. By

bringing the sources closer to loads contribute to the enhancement of the voltage profile, reduction of distribution and transmission losses, and postpones the investments in new transmission and large scale generation systems. The main changes in the modern distribution network due to the inclusion of DG technologies are the bidirectional power flow; the uncertainty in bus voltage profiles and the uncertainties in short-circuit power.

II. LITERATURE REVIEW

Most of work on power quality is concerned with the customer related issues and classification of power quality disturbances in conditions such as switching of the equipments or power system operations. This work aims at to detect power quality disturbances in the faulty conditions of the power system and improvement of power quality in faulty conditions of power system using three phase single tuned and double tuned harmonic filters as well as by using the proposed NPF. The four bus system with two load and two generator buses is simulated in MATLAB/Simulink environment. The power quality detection and improvement using three phase harmonic filters connected at generator bus during LG fault, LL fault, LLG fault, LLL fault and LLLG fault on the load bus has been studied. The proposed NPF is used to improve the power quality. The results obtained after simulation demonstrate the performance of proposed NPF and show its effectiveness over the three phase harmonic filters in improvement of power quality during faulty conditions of power system.

Voltage events can be classified by two parameters: magnitude and duration. For detection and restoration of these events wavelet Transform (WT) is used in this paper.

Now a day it become very useful tool because it has many advantages compare to other tools like Fourier Transform (FT), Short Time Fourier Transform (STFT) etc. FT gives the information about the frequency but it can't give the information at what time this frequency occurs. Hence it is useful only for stationary signal. Signals which occur in power system is generally non-stationary, and for these signals WT is appropriate [4]. STFT is better as compare to the FT, but it has fixed window size. Because of this fixed window size, the resolution of system can't be changed according to our requirement. All these drawbacks are overcome in WT. There are various studies which show the use of WT for power quality disturbance classification [5-9]. Wavelet transform is used for many purposes in power system such as: harmonic reduction, fault location etc. In [10] fault locating in radial distribution system using wavelet transform and neural network is described in detail. For analyzing the signals its feature extraction is done which is given in [11]. Voltage sag and swell can be restored by many methods. Dynamic voltage restorer in [12] is used for the compensation of voltage interruptions. Kalman filter is also used for the detection of voltage sag. Artificial neural network and fuzzy logic based voltage sag source location technique is described in [13]

According to [14] proposes a new method of sag and swell detection based on wavelet transform and its restoration. For good accuracy of system discrete wavelet transform (DWT) with multi resolution analysis (MRA) is used. Feature of input signal is extracted by selecting Daubechies wavelet (Db4) as mother wavelet. Advantages of Db4 wavelet compare to other wavelets are described. The simulation results for sag and swell restoration are presented. Block diagram, wiring diagram and hardware scheme of the developed model is explained.

According to [15] the fundamentals of WT, its distinctions from Fourier transform and the results of an extensive literature review of published studies are presented. The results of the literature review reveal that the detection of PQ disturbances using WT is a very powerful method and has been used in PQ mitigation devices effectively (that is, Custom Power, Flexible AC Transmission System, Flexible, Reliable and Intelligent Energy Delivery System).

III. RESEARCH GAP & FUTURE OBJECTIVE

The paper carried out during the course of this research is focused mainly on the utility network aspects of PQ during faulty conditions. In the past decade, the grid users have detected an increasing number of drawbacks caused by electric power quality (PQ) variations and PQ problems have sharpened because of the increased number of loads sensitive to PQ and have become more difficult to solve as the loads themselves have become important causes of degradation of quality. In spite of having impact of consumer loads, the PQ disturbances are also propagated in the utility network and produces negative impacts on the performance of the power network. In power quality voltage is the most important factore so here lots work are done in the feild of voltage quality improve for batter PQ. But still there is lots of issues on all those previous approaches are those are followings:

- Quality of filter approach is not sufficient to improve the quality of voltage level.
- There is lots of time require for the improvement of voltage quality by using of all previous existing approaches.
- Still there is lots glitch are available after the filtering approaches.
- In terms of cost factor most of the previous existing approach are not cost efficient due to large way of filtering process.

Future Objectives:

This paper presents some future research area for detection and restoration of voltage sag and swell. Here all are our main future objectives:

1. Improvement in voltage quality with the smart filtering system.
2. Here we are targeting to reduce the cost issue which is the main drawback of previous existing approaches
3. Here we are try to improve the quality of voltage in less time because time is also a big factor which are not solve by the previous existing approaches.

IV. CONCLUSION

The reduction in power quality is really a big issue when we are talk about the smart gird or power grid system. If our generated voltage quality is not good enough so automatically our entire system face a challenge which is known as power loss. In this paper basically we present the comparative study between all existing power quality improvement system. Here we got lots of future scope for this area which is require to solve the existing system issue.

REFERANCES

[1] Adly A. Girgis, John W. Stephens and Elham B. Makram, 'Measurement and Prediction of Voltage Flicker Magnitude and Frequency', *IEEE Transactions on Power Delivery*, Vol. 10, No. 3, July 1995, pp1600- 1605.

[2] A. Elnady, *IEEE*, and Magdy M. A. Salama, 'Unified Approach for Mitigating Voltage Sag and Voltage Flicker Using The DSTATCOM', *IEEE Transactions on Power Delivery*, Vol. 20, No. 2, April 2005, pp992-1000.

[3] A. K. Pradhan, A. Routray, and AbirBasak Power, 'System Frequency Estimation Using Least Mean Square Technique', *IEEE Transactions on Power Delivery*, Vol. 20, No. 3, July 2005, pp1812-1816.

[4] Ali Asheibi, David Stirling, and Danny

Sutanto,'Analyzing Harmonic motoring data using supervised and unsupervised learning,' *IEEE Transactions on Power Delivery*, Vol.24, No.1, January 2009, pp 293 -301.

[5] V. Kumar, S. K. Gawre, T. Kumar "Power Quality Analysis Using Wavelet Transform: A Review," International Conference on Innovations in Engineering and Technology, 2014.

[6] Oyedoja, kayode. O, Obiyemi, Obiseye. O "Wavelet transform in the detection of electrical power quality distuabances," International Journal of Engineering and Applied Sciences, Vol. 3, No. 2, April 2013.

[7] SudiptaNath, ArindamDey and AbhijitChakrabarti "Detection of Power Quality Disturbances using Wavelet Transform," International Journal of Electrical, Computer, Energetic, Electronic and Communication Engineering Vol:3, No:1, 2009.

[8] Dr. M. Sushama, Dr. G. Tulasi Ram, Dr. A. Jaya Laxmi "Detection of Power Quality Disturbances Using Wavelet Transforms," Dept. of EEE, JNTUH College of Engineering, Hyderabad, INDIA.

[9] Bhavna Jain, Shailendra Jain and R.K. Nema "Investigations on Power Quality Disturbances Using Discrete Wavelet Transform," International Journal of Electrical, Electronics and Computer Engineering 2(2): 47-53,2013.

[10] MeisamPourahmadi-Nakhli "Path Characteristic Frequency-Based Fault Locating in Radial Distribution Systems Using Wavelets and Neural Networks," IEEE transactions on power delivery, vol. 26, no. 2, April 2011.

[11] Julio Barros, Ramón I. Diego, Matilde de Apráiz "Applications of wavelets in electric power quality: Voltage events," Electric Power Systems Research 88 ,2012.

[12] Anita Pakharia, Manoj Gupta "Dynamic Voltage Restorer for compensation of Voltage sag and swell: A literature review," International Journal of Advances in Engineering & Technology, July 2012.

[13] D.Justin Sunil Dhasa, T.Ruban Deva Prakashb , P.Jenopaul " Voltage Sag Source Location Using Artificial Neural Network," International Journal of Current Engineering and Technology, vol.2, no.1, March 2012.

[14] Agrawal, Shilpi, and MangalHemantDhend. "Wavelet transform based voltage quality improvement in smart grid." *Automatic Control and Dynamic Optimization Techniques (ICACDOT), International Conference on*.IEEE, 2016.

[15] SARIBULUT, Lütfü, T. E. K. E. Ahmet, and Mehmet TÜMAY. "Fundamentals and literature review of Fourier transform in power quality issues." *Journal of Electrical and Electronics Engineering Research* 5.1 (2013): 9-22.

[16] KristinnKristinnsson, and Guy A. Dummount, 'System Identification and Control of Dynamical Systems', IEEE Trans. Systems, Man and Cybernetics, Vol. 22, No. 5,pp 1033-1046,Sept./ Oct.1992

[17] P. Acharjee, and S. K. Goswami, 'An Adaptive Particle Swarm Optimization Based Method for Normal and Low Voltage Multiple Load Flow Solutions,' Conf. POWERCON 2008.

[18] Kazarlis S. A., Bakirtzis A. G., and Petridis V. , ' A Genetic Algorithm Solution to the Unit Commitment Problem,' IEEE Trans. on Power Systems, Vol. 11, No. 1, Feb. 1996,pp 83-92.

[19] G. K. Singh, 'Power System Harmonics Research: a Survey', European Transactions on Electrical Power, Vol. 19, No. 2, March 2009, pp 151-172.

[20] José AntenorPomilio, and Sigmar Maurer Deckmann, 'Characterization and Compensation of Harmonics and Reactive Power of Residential and Commercial Loads,' IEEE Transactions On Power Delivery, Vol. 22, No. 2, April 2007, pp1049-1055.