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A Novel Approach for Intelligent Electricity System by using Matrix Converter

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Abstract

This proposed model provides an intelligent control of frequency variations in the distribution system due to direct tapping on the line or bypassing the meter. The existing system uses step down cycloconverter or variable frequency drive to step down the fundamental frequency from 50 Hz to 10 Hz of the distribution transformer [1] where no load could work properly and then distribute the power which thereby causes many fluctuation in frequency. Our proposed system uses matrix cycloconverter which is bidirectional and thus reduces the frequency variations in the line and thus provides a efficient use by the legal consumers. Matrix converter has an inherent bidirectional energy flow capability and the input power factor can be fully controlled. Hence this system provides an efficient way of proceedings the intelligent controller of electricity theft due to direct hooking's or tapings on the distribution line. The proposed model has been realized and analyzed in Matlab.

Keywords*: Microcontroller, Zero cross detector, Bi directional (four quadrant),*

INTRODUCTION

More than 23 percent of the total power generated in India was wasted during transmission and distribution (T&D) in the country. Power generated in power stations pass through large and complex networks like transformers, overhead lines, cables and other equipment and reaches at

the end users. It is fact that the unit of electric energy generated by Power Station does not match with the units distributed to the consumers. Some percentage of the units is lost in the distribution network.

Matrix converter can provide the amplitude and frequency conversion, bi-directional power flow. A voltage smoothing capacitor is required in the DC link circuit, and an electrolytic capacitor is typically used for this purpose. On the other hand, the matrix converter arranges semiconductor switches into a matrix configuration. A microcontroller can be used as a substitute for other integrated circuits, or ICs. It can also be easily reprogrammed to modify its function. A microcontroller is a computer present in a single integrated circuit which is dedicated to perform one task and execute one specific application. As per scenario in distribution system over 20% power losses as transmission loss is 4-6% and distribution loss (overload or theft) is 15-18%. The electrical power deficit is 18%.Clearly reduction in distribution losses can reduce this deficit significantly. It is possible to bring down overload losses up-to 6-8%.With the help of newer technology option including information technology in electrical power distribution sector which will enable better monitor and control.

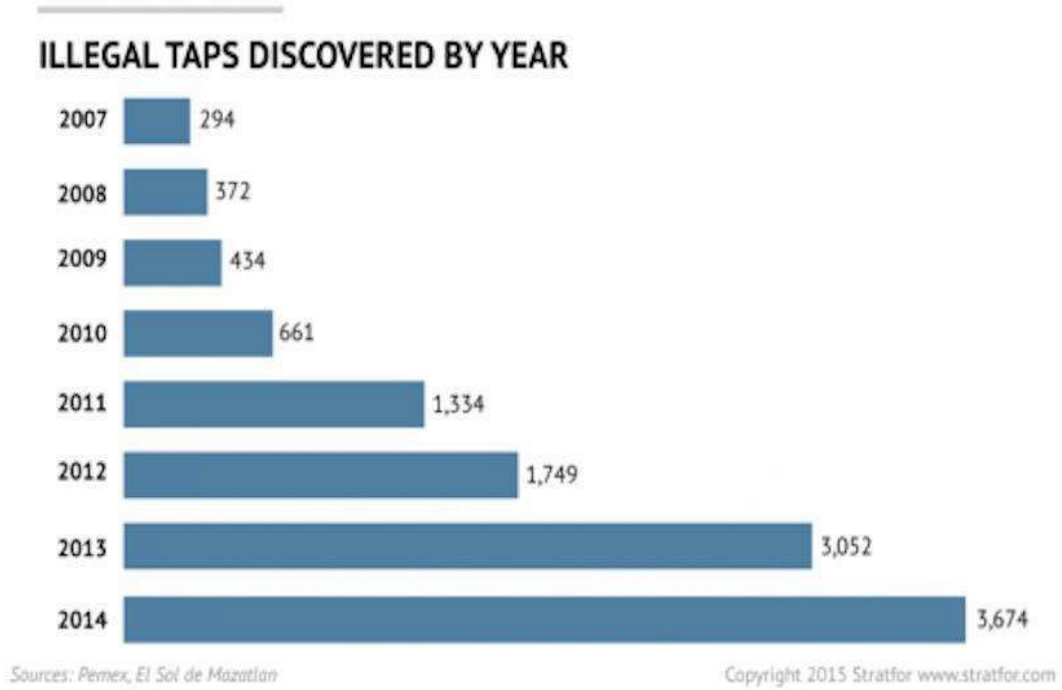

Fig.1 Survey Report

LITERATURE SURVEY

[1]Amritpal Singh "INTELLIGENT ELECTRICITY THEFT CONTROLLER", Published in International Journal of Engineering Science and Management, Volume 4, Issue 2, December 2016 this scheme is based on the intelligent control for electricity theft in distribution system due to direct tapping on LT line or bypassing the meter.

Here we use three phase step down cycloconverter or variable frequency drive to step down the fundamental frequency of three phase supply from 50 Hz to 10Hz of the distribution transformer 11kV/0.4kV or pole mounted substation where no load could work properly and then distribute the power, but for the legal consumer another single phase step up cycloconverter/variable frequency drive merged with the energy meter of the consumer to step up back the frequency level to 50 Hz. Hence being the intelligent controller of electricity theft due to direct hooking‟s or tapings on the distribution line.

[2] Siyoung Kim, "AC/AC Power Conversion Based on Matrix Converter Topology with Unidirectional Switches", Published in International Journal of Industry Publications, January 2010 .In this paper, a new type of ac/ac converter is pro- posed. The proposed converter is capable of direct ac/ac power conversion and, except for a few small snubber elements; it does not require the use of any input inductors or a dc-link capacitor. In contrast to the matrix converter, which requires bidirectional switches, the proposed converter consists of only unidirectional switches such as insulated gate bipolar transistors. The converter has a unity input displacement power factor, and its input line current waveform is similar to that of a diode rectifier with a dc-link inductor.

[3] Vinod Kumar, Ramesh Chand Bansal," Experimental Realization of Matrix Converter Based Induction Motor Drive under Various Abnormal Voltage Conditions", Published in International Journal on Control Automation System , Volume 6, Issue 2, October 2008. While the matrix converter has many advantages that include bi-directional power flow, a size reduction, a long lifetime, and sinusoidal input currents, it is vulnerable to the input voltage disturbances, because it directly exchanges the input voltage to the output voltage.. For this, a 230V, 250VA three phase to three phase matrix converter (MC) fed induction motor drive prototype is implemented using DSP based controller

and tests have been carried out to evaluate and improve the stability of system under typical abnormal conditions.

[4] Pratap Junale, Avinash, "Electricity Theft Detection Survey", Published in International Journal in Advanced Computer Science and Software engineering, Volume 6, Issue 2, February 2016,This paper explains about the Electricity distribution authorities loose a large chunk of income, due to illegal connections or dishonesty of customers for their personal gains. The methods like Support Vector Machine (SVM), Fuzzy C-means Clustering, Fuzzy logic, User profiling, Genetic Algorithm, etc. are used to detect theft in electricity. There are two disadvantages associated with using these systems based on this methodologies is accuracy and also the infrastructure needed to employ them (like smart energy meter)

EXISTING SYSTEM

See Figure:-2 In this system, the three Phase Step down cycloconverter used three individual six pulse single phase step down cycloconverter with each phase of LT line, which converts the fundamental frequency of 50Hz to 10Hz.Step down Cycloconverter basically consists of SCR‟s or thyristors divided in two groups one being Positive or P-converter and other Negative or N-converter and works on natural or line commutation of thyristors.

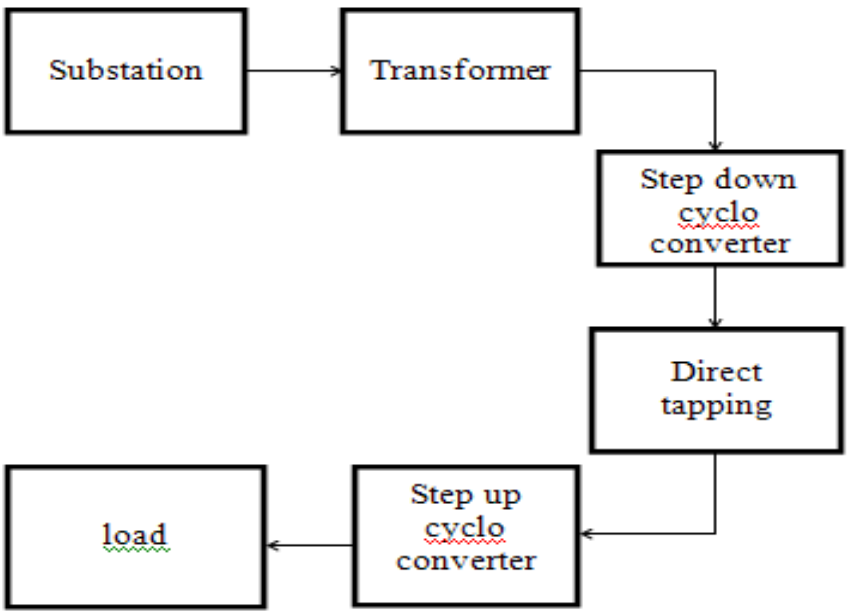

Fig:-2 Block diagram of existing system

The internal circuit diagram showing the assembly of the eight SCR‟s or thyristors forming the P-converter and N-converter of the single phase step down cycloconverter used with each phase coming out of the distribution transformer for stepping down the frequency to 10hz is shown

Demerits of Existing System

- Total harmonic distortion is high
- Due to direct tapping, the consumer loads are affected.
- More switches are used

PROPOSED SYSTEM

The effects of frequency variation in the consumer load are totally protected and a bidirectional matrix cycloconverter is used. The total harmonic distortion is reduced to 4.4%.From the transformer ,the AC signal is given to the microcontroller by converting the AC signal to DC with the use of analog to digital converter .A Zero cross detector is used for voltage comparison. The output from microcontroller is given to the Optocoupler which is used to prevent the damage of electronic components by isolating them from high voltage.

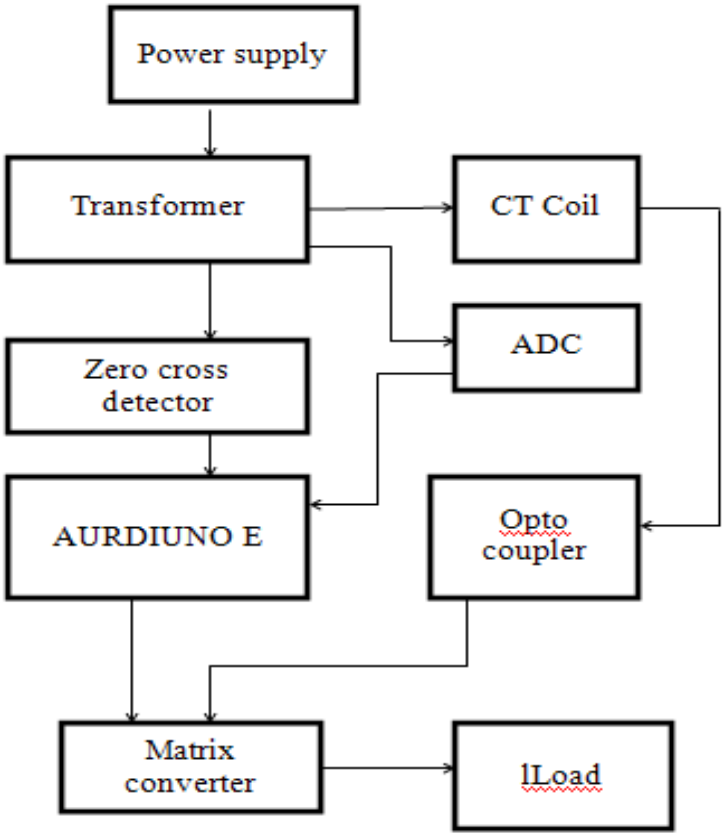

Fig:-3 Block diagram of proposed system

CTs can be used to monitor the main utility feed conductors for a facility or residence, conductors that feed sub panels, and conductors for individual circuits such as pumps, motors, air conditioning, car chargers, and lighting loads. CTs can also be used to monitor conductors from generators as well as renewable energy systems such as solar PV systems, wind generators and hydro power systems. A matrix converter is defined as a converter with a single stage of conversion. It utilizes bidirectional controlled switch to achieve automatic conversion of power from AC to AC Matrix converter can provide the amplitude and frequency conversion, bi-directional power flow and input displacement factor control without the presence of bulky life limited capacitors and other passive element. The process of switching on and off the bidirectional switch made the variable frequency and amplitude signals at the output of the matrix converter. It contains memory, programmable input/output peripherals as well a processor. The advantages of using a microcontroller are reduced size of circuitry and increased flexibility.

Methodologies

Firstly, the matrix converter (MC) and modulation strategies are simulated using ideal components in MATLAB^{r}. The system is assessed and is then simulated in the PSCAD^{r} / EMTDC^{TM} simulation environment to represent the behavior of non-ideal components. A current commutation controller is developed for use in PSCAD^{r} EMTDC^{TM} to ensure that the MC is able to function effectively. Power flow control in an MC is simulated in PSCAD^{r} / EMTDC^{TM} and analysis is conducted by exporting the results into MATLAB^{r} for post processing. The WRIM model is tested in PSCAD^{r} / EMTDC^{TM} using free acceleration tests.

A pump load is also applied to the machine to illustrate the characteristics of the machine under loaded conditions. From this the DFIG control theory investigated in the literature review is evaluated using an ideal voltage source in the rotor circuit of the WRIM. This is extended by applying the MC model to the rotor circuit of the WRIM model replacing the ideal voltage sources thus creating a complete DFIG model. The model is then simulated under a variety of conditions and the results are analysed using Fast Fourier Transforms to determine the Total Harmonic Distortion in the MATLABr environment. The analysis is presented in the thesis with conclusions and recommendations for future work.

SOFTWARE RESULTS

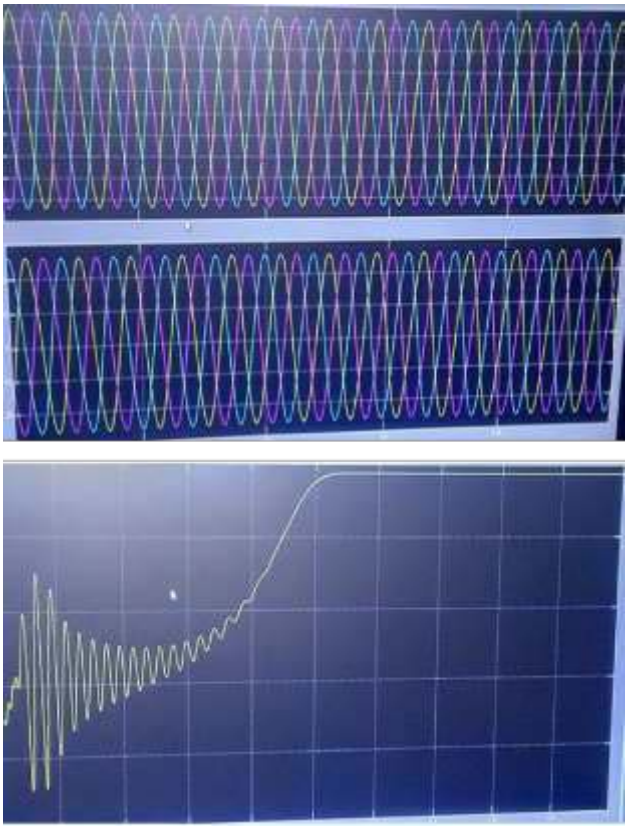

Figure:-4

From this above figure shows that the level of harmonic losses reduced by using MATLAB software.

CONCLUSION

Our proposed system enables a decreased total harmonic level in the distribution line during the electric theft by tapping .This project can provide a complete protection to the distribution line which no way affects the consumer load .From the present data, the three phase step down cycloconverter containing Total Harmonic Distortion(THD) of about 23.57% and also produces complex harmonics. These highly complex harmonics are usually filtered out by the machine inductance and thus results in a tedious process. Our developed prototype model ensures the consumers with a exact frequency level of about 50Hz. Thus the effects of frequency variation in the load are totally protected. A harmonic level is reduced of about 4.4%.

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