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DESIGN AND IMPLEMENTATION OF ONLINE POWER MONITORING SYSTEM FOR SMARTGRID USING LABVIEW

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Abstract

In this paper it is introduced that the Design and implementation of Smart Grid with voltage, current, power, power factor and power quality measurement and monitoring using LabVIEW is designed. The existing method of power monitoring has the drawback of incorrect measurements due to weather condition. There are different types of loads in industries such as resistive, inductive and capacitive loads. Generally Industries having more inductive load , due to this inductive load power factor comes down, it can be measured by using NI-MyDAQ toolkit and improve the power factor by switching the capacitor bank automatically. If there is any overload occurs, it can be removed by using relay circuit through overload indication in lab view front panel virtual instrumentation. Through this system, we can overcome the problem of expenses of measurement devices like ammeter, voltmeter, harmonic analyzer and power factor measurement devices.

Key Words - Lab VIEW ,NI-my DAQ Tool kit, Power factor, Power Quality, Smart grid

1) Introduction

In recent years, a great quantity of electrical loads characterized by non-linearity, impact strength and unbalance at the user side have caused a serious interference and pollution to the quality of power supplied. The typical problems existing in power quality such as harmonic, asymmetry of the three-phase circuit, voltage fluctuation and flicker, etc. are all becoming worse, while, with the development of technology a number of new-type electrical loads which are sensitive to power quality are developing rapidly, requiring high-quality power to be supplied by power system[1-2].

Nowadays, the voltmeter having a simple statistical function is widely used in China to monitor the voltage, while, these voltmeters can only monitor the rate of voltage, [3-4]. However, with respect to the measurement of harmonic order and voltage fluctuation and flicker, the portable measuring instrument is applied to make an onsite measurement, and according to the data measured, a summarization and statistical analysis will be carried out to make an evaluation on the quality level of the power supplied by the power system. The different existing methods of power quality monitoring which is already in use which includes all existing technologies involved in the field of power quality monitoring is surveyed in [5]

In consideration of the problems existing in the current online monitoring instrument, and in line with the state-level standards concerning power quality in China, an online power quality monitoring system based on LabVIEW which is suitable for the power quality monitoring is designed. LabVIEW is a programming language used for acquiring signal, data presentation and measurement analysis. The LabVIEW platform provides models and specific tools to solve applications ranging from signal processing algorithms to voltage measurements, targeting number of platforms interfacing desktop and embedded devices.

The use of LabVIEW software platform for power quality detection and interpreted system characteristics harmonic detection, voltage, current waveforms which includes their deviations is proposed [6]. The design of a multifunctional Virtual monitoring system which monitors the power quality and then implemented in LabVIEW environment is designed. The root mean square (RMS) value, the waveforms of current and voltage, current and voltage crest factor, the harmonic components, the total harmonic distortion (THD) waveforms of the voltage and current signals can be calculated and displayed in the system [7].

Here the Experimental setup has been made using resistive, inductive and capacitive loads where the

measurements of electrical parameters are monitored through the LabVIEW through

2) Simulation Results

The following system parameters measurement under distorted system conditions (Harmonics, RMS Voltage Vrms , RMS Current Irms , Total Harmonic Distortion (THD), Real Power, Reactive Power, Apparent Power are the objective of the work. The above system parameters are simulated using LabVIEW software under normal and distorted conditions. These parameters are simulated analytically.

The Fig 1-5 shows the Block diagram for the measurement of RMS Current, RMS Voltage, Apparent Power, Real power and Reactive power.

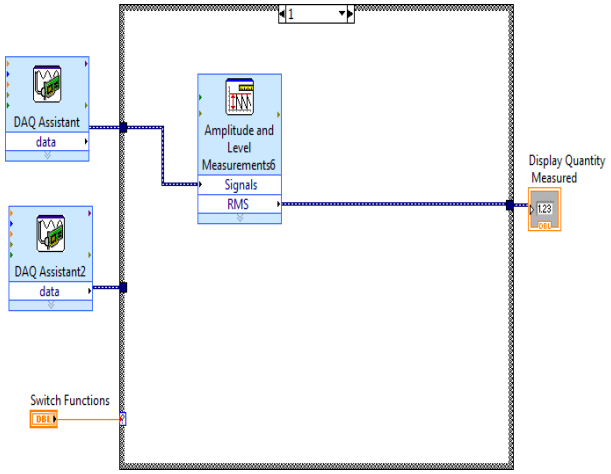

Fig.1 Block Diagram for RMS current calculation

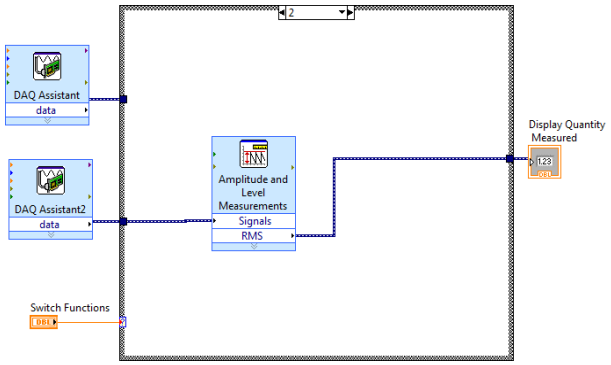

Fig.2 Block Diagram for RMS voltage calculation

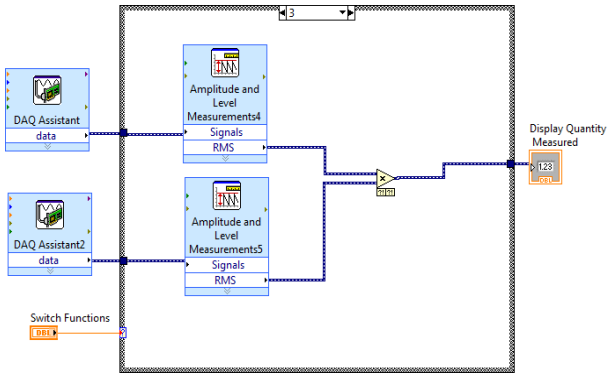

Fig.3 Block Diagram for apparent power calculation

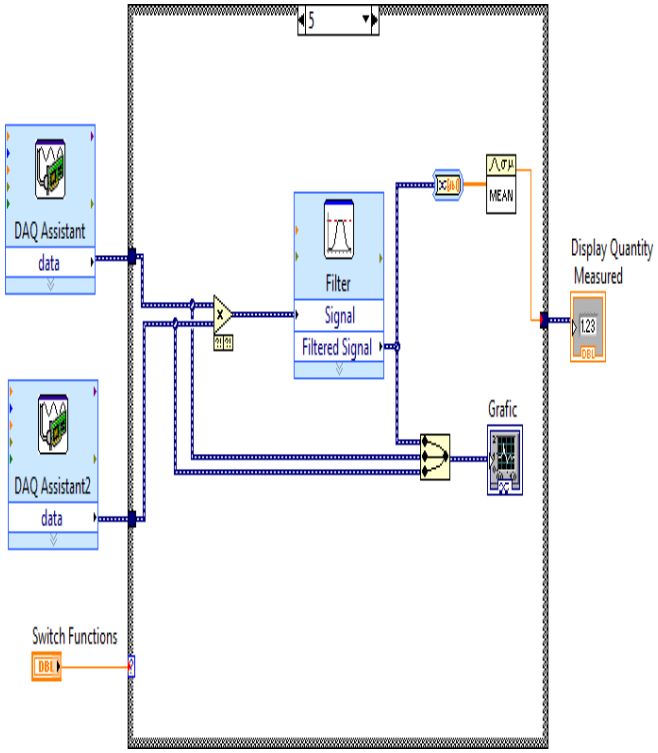

Fig.4 Block Diagram for active power calculation

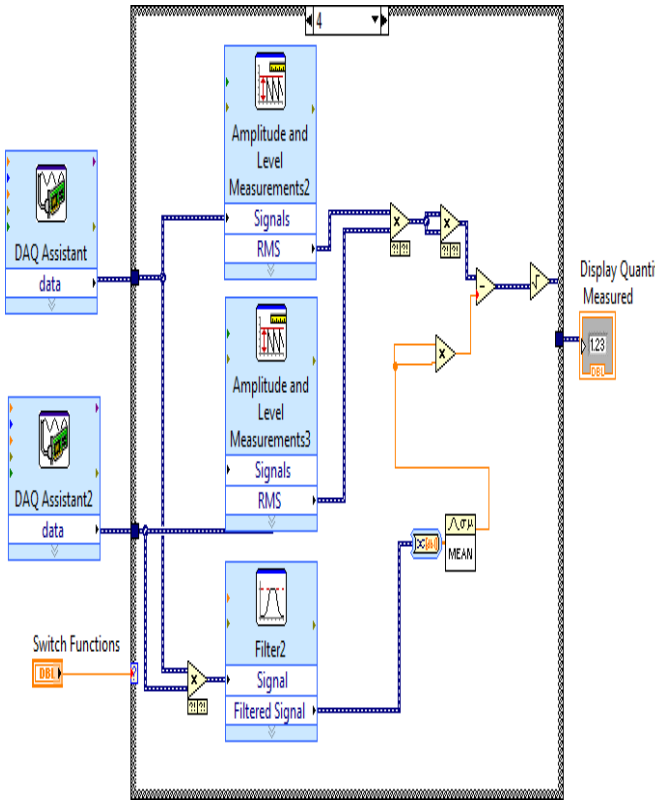

Fig.5 Block Diagram for reactive power calculation

The experimental setup was made for Inductive, Resistive and Capacitive loads. The Data acquisition (DAQ) system for remote monitoring of power quality has been successfully developed using LABVIEW and tested with hardware setup. Voltage, Current, Real Power, Reactive Power, Power factor and THD values are calculated for the operation of various loads and the results are calculated on the front panel on a computer screen called virtual instruments.

THD waveforms for distortions and its values are shown in Fig.6. The RMS values of Voltage and currents and the real power, reactive power values displayed in front panel are shown in Fig.7.

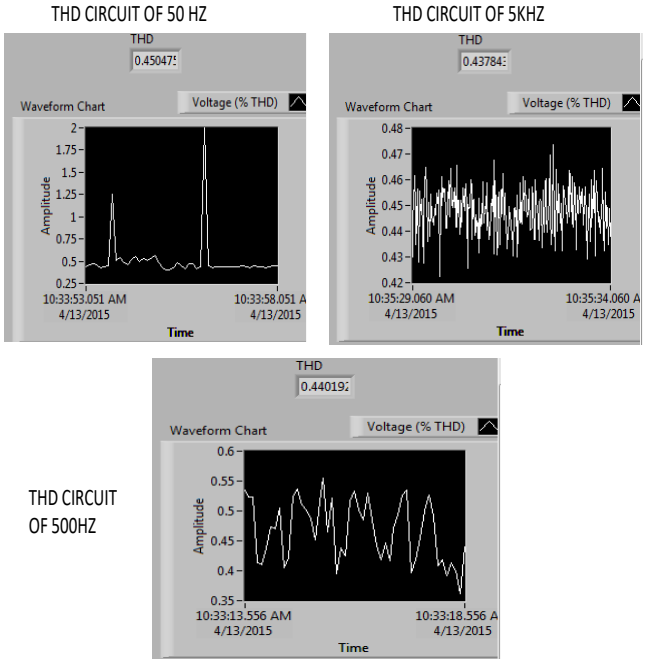

Fig 6. THD measurements

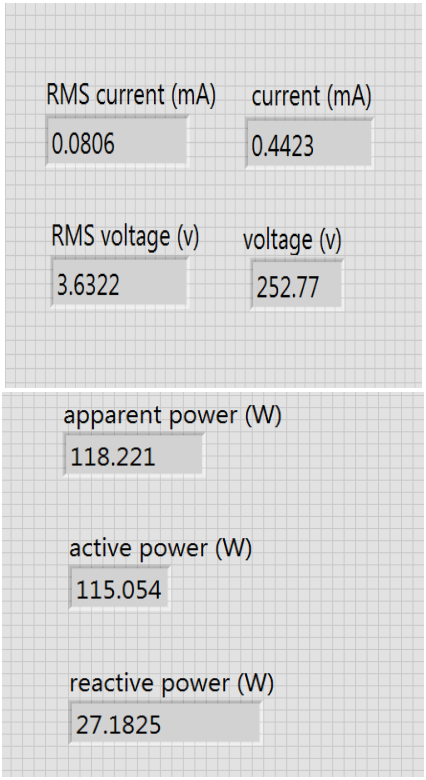

Fig.7 Simulated output values I,V, Power

The setup is also modeled for Overload indication. The frequency and Power factor values are continuously monitored in parallel with the load. The overloading condition is indicated in the front panel when the load tends to be raised or overloaded. Fig.8 depicts the Overload monitoring.

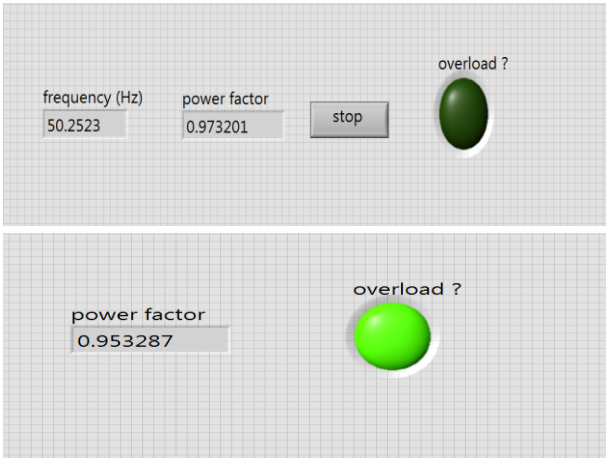

Fig.8 Overload Indication

The Figure 9 below depicts the Experimental setup for DAQ system where results are monitored on the front panel on a computer screen called virtual Instruments.

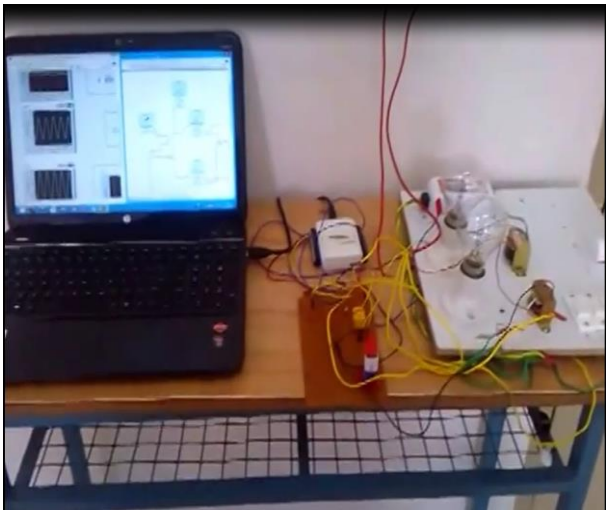

Fig.9 Experimental setup

Conclusion

The study of electrical power systems requires a good background on advanced mathematics. But many engineering and technology students lack this required background, and as a result, it is difficult to teach electrical power systems in these programs.

This problem can be effectively addressed by improving the student's conceptual understanding and comprehension of the topics through interactive learning and teaching with a virtual instruments (VI) software package, such as LabVIEW.

NI LabVIEW is an open environment designed to make interfacing with any measurement hardware simple. It combines data acquisition, analysis, and presentation tools into one software program. With interactive assistants, code generation, and connectivity to thousands of devices, LabVIEW makes gathering data as simple as possible.

Because Lab VIEW provides connectivity to virtually any measurement device, you can easily incorporate new Lab VIEW applications into existing systems without losing your hardware investment. Regardless of your hardware requirements, Lab VIEW provides an interface to make connecting to your I/O easy.

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