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Smart Power Quality Monitoring Using Arduino Controller

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ABSTRACT

In recent years, the uses of non- linear power system loads have increased. So accordingly, the harmonic pollution to power line quality is growing. Due to the current technological advances, and the convenience of life and livelihood equipment increasing, this also increases power consumption, so that the frequency changes are quite common. The degree of change varies depending on load characteristics and design of the power supply system. In the power line system operation, when the frequency is lower than the nominal value, the system is under the overloaded condition. If the frequency is higher than the reduction

I. INTRODUCTION

Power quality monitoring is the process of gathering, analyzing, and interpreting raw measurement data into useful information. The process of gathering data is usually carried out by continuous measurement of voltage and current over an extended period. The process of analysis and interpretation has been traditionally performed manually, but value, it shows the oversupply of the power line. The role of frequency represents whether the power line reaches a state of equilibrium between supply and demand, so frequency is a very important indicator for the reliability, safety and economy of the power line system.

Arduino is used to build a low-cost data capture card combined with mobile devices to build a portable power line frequency detection platform. By observing changes in the frequency, we can immediately detect the situation of the power line system operation, and the interference of power line quality can also be monitored simultaneously.

recent advances in signal processing and artificial intelligence fields have made it possible to design and implement intelligent systems to automatically analyse and interpret raw data into useful information with minimum human intervention. Power quality monitoring programs are often driven by the demand for improving the system wide power quality performance. Many industrial and commercial customers have equipment that is sensitive to power disturbances, and, therefore, it is more important to understand the quality of power being provided. Examples of these facilities include computer networking and telecommunication facilities,

II. LITERATURE SURVEY

1. Ethernet based smart energy meter for power quality monitoring and enhancement (Himshekar Das, L C Saikia). With the increasing demand for power accompanied by unpaid bills, power theft and power quality problems, this is used to monitor and control customers about energy consumption.
2. FPGA based power quality monitoring using FFT method for single phase power metering (Parimala K V, Nisha KCR). Accurate measurement of electric parameters is required to determine the quality of power which involves voltage and current samples over a period of time
3. Wireless web based power quality monitoring system in micro grid (Batista and Bareto). An ARM Cortex M4F microprocessor and a wireless module that allows a bidirectional exchange of information between the smart meter and a data center.
4. A low cost power quality meter over the internet (Medeiros EC, Costa EL).
   A low cost three phase power quality meter, due to its characteristics the meter can be applied for residential or small bussiness use.
5. A Low cost power quality meter for utility and consumer assessments (Albert SO, Norman Tse).
   It is partially due to lacking of a world-wide accepted indicator, power performance index in our case and partially due to conventionally high cost of power quality measurement equipment. semiconductor and electronics manufacturing facilities, Bio-technology and pharmaceutical laboratories, and financial data-processing centers. Hence, in last decade many utility companies have implemented extensive power quality monitoring programs.

III. OBJECTIVES OF THE PROJECT

Overheating of generators, motors, transformers, and power cables that lead to early equipment failures can be rectified We can reduce Excessive losses that happen due to distortion. This prevents overheating of neutral conductors, and other electrical distribution equipment Capacitor failures, tripping of circuit breakers and loss of synchronization on timing circuits can be rectified. Does not need various meters to measure current, voltage, power, power factor and phase angle.

Proposed solution:

The current and voltage are measured using sensors. The phase angle can be measured by the time difference to reach peak value from the starting time. The values obtained by these term helps as to measure the power factor .The value of current and voltage are compared with reference current and voltage waves to measure Total harmonic distortion.

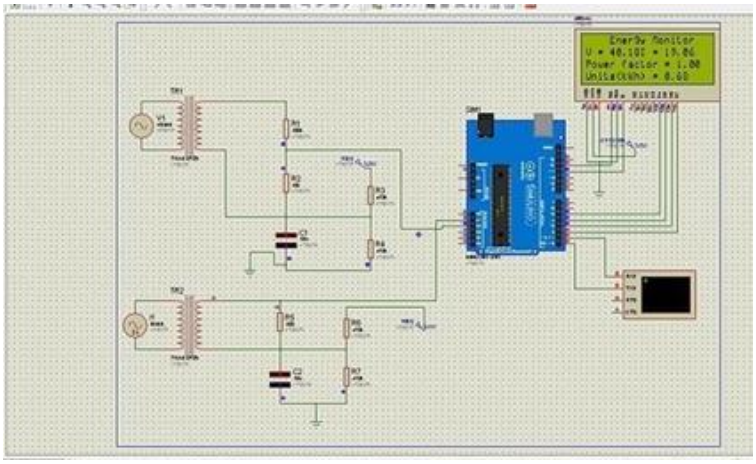
Methodology:

First we have to measure the current value of the load using the current sensor which has a range upto 30 A .The current sensor is connected series to the load and the digital value of current are calculated by an arduino microcontroller. The voltage values are measured by using voltage sensor which has a range upto 250 v. The voltage sensor is connected parallel to the load and the digital values of voltage are calculated by an arduino microcontroller.

Hall effect split core Ac current sensor is used to measure the phase angle by measuring the time difference between the current and voltage wave to reach peak when started from same starting point.

Hall effect split core Ac current sensor does not need physical connected, it takes reading by cover the wire. The value obtained by these sensors help as to measure the power, power factor and total harmonic distortion.

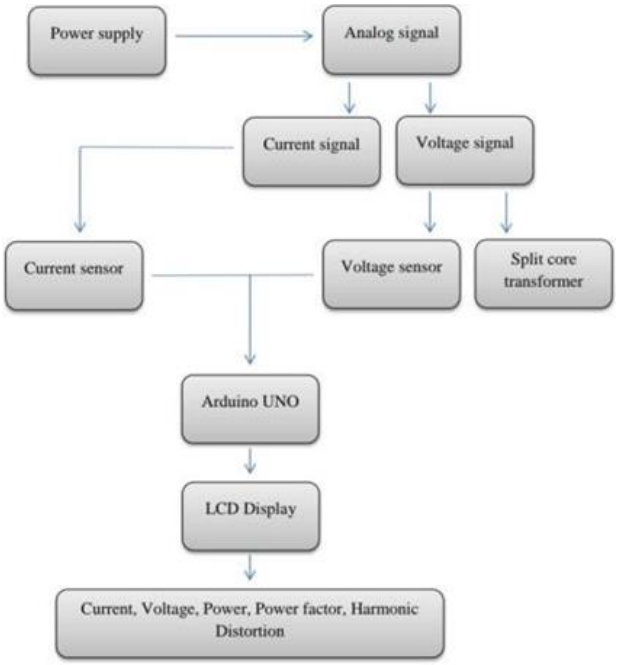
Design:



The current waveform is taken from the given supply and it compares with the reference waveform so that we can view the harmonics in the waveform. The voltage also compares the waveform in the same manner. With this we can find THD (Total Harmonic Distortion) value. The current waveform is compared with a reference value to check whether it has any frequency changes in the power signal. If there is any presence of frequency change then it may cause harmonic distortion in the power signal which will affect the life span of the equipment.

The current is required to compare it with the voltage waveform and it gives us the THD value in an approximate manners. The load connected across the circuit shows the THD value.

Flow chart:



IV. CONCLUSION

- This project is done using microcontrollers instead of using high number of hardware components.
- Power Quality measurement of different devices is possible.
- Updating this project to an IOT or Automation based technologies is very easy.

V. REFERENCES

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