Implementation of a Domestic Power Line Quality Measurement System

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***Abstract*— Electricity has become a vital commodity in the contemporary world. People use electricity to fulfill most of their day-to-day needs. For a better electricity supply network, two parameters should be satisfied namely, reliability and power quality. After fulfilling the reliability criteria of the electricity network, the consumer will expect a regulated and cost effective supply of power. Therefore, monitoring and analyzing the quality of the power supply becomes a major requirement. However, electricity service providers do not always disclose the power quality to consumers, particularly in developing countries. Moreover, in some places the service providers do not even measure the quality. Thus, it is left to the consumers to measure the power quality if there is a concern about it. This paper discusses implementation of a simple power quality analyzer which includes data collection, storage and power quality analyzer. Different quality parameters which are used to describe a power supply have been taken into the analysis.**

Keywords*— *Power quality, Data collection, Power quality parameters

I. INTRODUCTION

Maintaining the quality of the electric power supplied to the consumer is always a challenge for the utility provider. Even though this problem has existed since the beginning of the electricity network, it has not always been the main concern. Instead, the reliability of the service took the first place. Nowadays, the scenario changes as many consumers started to consider the quality of the power supply as well. This difference occurred mainly due to the increase in the usage of equipment with strict power supply parameters. Recent studies [1] show that people are willing to get good quality power supply even at the expense of increment in the tariff. Hence, studies on measuring and maintaining the quality of power supply become significant.

An Early problem encountered under the power supply quality maintenance was the consumption of higher current for a given active power and voltage level. This phenomenon leads to the definition of active, reactive and apparent powers and power factor [2]. But, the concept of power factor was suited only for the sinusoidal conditions. With the advancement of technology, power electronic devices began to emerge into the system rapidly. Moreover, variable frequency drives (VFD) were introduced for controlling electric motors. In addition to that, the concept of a hybrid system which combined both AC and DC power supply started to rise. These advent improvements brought new quality degradations to the power system. The development of these nonlinear and time variant loads introduced new quality degradations such as harmonic distortion, transient disturbances and voltage spikes. The usual loads in a home are slowly varying in regards to power consumption. Therefore, incorporating voltage regulators would eliminate the effects of voltage drop from such loads. In contrast, industrial loads such as arc furnaces and welding/soldering plants are having rapidly variable power consumption. This would lead to different phenomena such as sags, swells, notches and flicker. A conventional electricity network is composed of interconnection of different loads which are in possession of different consumer. Thus, the problem became even worse when the degradation on the loads of one consumer causes degradation on the loads belongs to different consumers. Therefore defining regulations on the quality of the power system has become an impelling need for both the providers and the consumers of electricity.

After setting up the regulations and standards on maintaining the quality of a power system, it is essential to monitor the system, especially on the consumer side to check whether the prescribed limitations were fulfilled.

A study [3] summarizes the main electric appliances which are used commonly in a home that cause the degradation in electric power quality. For example, the current drawn by a normal refrigerator contains 3rd and 5th harmonic components. Moreover the power factor and the displacement power factor correspond to a refrigerator is also very poor. In case of a microwave oven the quality degradation becomes even worse with the total harmonic distortion (THD) more than 30 %. Even though the induction heat plate does not cause significant degradation when it is working, it will inject very high harmonic currents when it is in the stand-by mode. Moreover, its power factor becomes worse at stand-by mode. Recent advancements in the personal computers (PC) made them affordable to a wide range of people. The penetration of

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