A Distributed Monitoring System For Power Quality

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Abstract- In the present paper, prototype architecture for a distributed system for online power quality parameters monitoring is illustrated. An interconnection between two different server types was performed.

I. Introduction

The remote processing and exchange of information on geographically distributed systems is a reality that becomes more and more integrating part of the technical and civil life. In this context the automation of measurements and monitoring receives a new impulse in the direction of remote execution and result processing. The approach to networking for the measurement automation is required in all the cases where several remote users should have access to a measurement station or share the results of a distributed measurement process [1-8]. The collaboration of parallel processes is intrinsic, and the remote control and monitoring are realizable. New software technologies that make the whole system really utilizable are required. Properties such as data throughput and real-time constrains have to be satisfied, so bandwidth and determinist behalf of the network are indispensable. Nowadays the concept of the virtual instrumentation is widely used in the measurement area.

Power quality is a relatively obscure concept, limited mostly to conversations among utility engineers and physicists, but as electronic appliances take over the home, it may become a residential issue as well. Most new electronic equipment, while more efficient than its mechanical predecessors, consumes electricity differently than traditional mechanical appliances. While older devices like incandescent bulbs use power as it is supplied by the utility, electronic devices draw currents in bursts, altering the electricity that flows through them, so that what comes out the other side and returns to the grid is distorted. This "dirty" power under utilizes utility equipment and increases line losses. Thus, some of the efficiency gained through improvements in appliances is lost in the transportation of the electricity that runs them. Additionally, utilities must invest in filters and capacitors to "clean" this dirty power. Poor-quality power also causes transformers, cables and other transmission equipment to burn out more quickly, thus increasing utility equipment costs.

For customers, power quality first emerged as an issue in industrial and manufacturing facilities. Tiny power disturbances wreak havoc with the increasingly complicated, computerized machinery found along assembly lines today. Computers can crash and data will be scrambled. The stakes are high--work stoppages can cost a company up to $500,000 an hour.

II. System feature

A measurement remote system for power quality monitoring is proposed [9,10]. The architecture is composed by to part: user and measurement provider as shown in figure 1. The users are able to observe, real time, via a commercial web browser all monitored device transformation. Number of users connected in the same time is unlimited. The main web page is located in server that allows the access to measurement station, using a connection link. In this machine a web server is run. The labview server represents the back up for the measurement stations. Our application survey, save and send to user by email the sequences containing the following events:

- Temporary Interruption: planned or accidental total loss of power. Duration: from 2 seconds to 2 minutes. Causes: equipment failure, weather, animals, human error (auto accidents, kites, etc). Effects: systems shut down;

- Long Term Outage: planned or accidental total loss of power. Duration: over 2 minutes. Causes: equipment failure, weather, animals, human error (auto accidents, kites, etc). Effects: systems shut down;
- Momentary Interruption: very short planned or accidental power loss. Duration: milliseconds to second or two. Causes: switching operations attempting to isolate an electrical problem and maintain power to measurement area. Effects: equipment trips off, programming is lost, or disc drive crashes;
- Sag or Undervoltage: a decrease in voltage. Duration: milliseconds to a few seconds. Undervoltages are Sags that are longer than a few seconds. Causes: major equipment start-up or shutdown, short circuits (fault clearing), undersized electrical circuit. Effects: memory loss or data errors, dim or bright lights, shrinking display screens, equipment shutdown or reset;

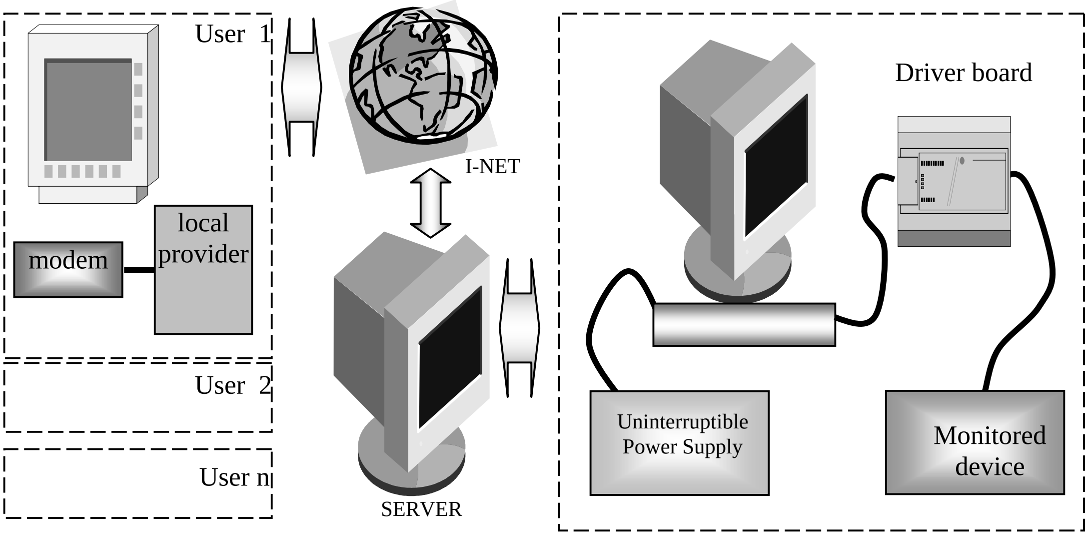

Figure 1. System architecture

- Swell or Overvoltage: an increase in voltage. Duration: milliseconds to a few seconds. Overvoltages are Swells that are longer than a few seconds. Causes: major equipment start-up or shutdown, short circuits (fault clearing), undersized electrical circuit. Effects: memory loss or data errors, dim or bright lights, shrinking display screens, equipment shutdown;
- Transient, Impulse, or Spike: a sudden change in voltage. Duration: microseconds. Causes: utility switching operations, starting and stopping equipment or machinery, static discharges, lightning. Effects: processing errors, data loss, burned circuit boards;
- Notch: a disturbance of opposite polarity from the waveform. Duration: microseconds. Causes: utility switching operations, starting and stopping equipment or machinery, static discharges, lightning. Effects: processing errors, data loss, burned circuit boards;
- Noise: an unwanted electrical signal of high frequency from other equipment. Duration: sporadic. Causes: electromagnetic interference: from appliances, microwave and radar transmissions, from radio and TV broadcasts, arc welding, heaters, from laser printers, thermostats, loose wiring, or from improper grounding. Effects: disturbs sensitive electronic equipment, but is usually not destructive. It can cause processing errors and data loss;
- Harmonic Distortion: an alteration of the pure sine wave (sine wave distortion), due to non-linear loads, on the power supply. Duration: sporadic. Causes: non-linear loads. Effects: causes motors, transformers and wiring to overheat.

Monitoring is performed using a virtual power disturbance analyser (figure 2). The analyser is capable of monitoring voltage, current, and providing a detailed record when measurements fall outside pre-set limits. It can be set to monitor the following general categories: high frequency events such as impulses and noise, voltage events (sags, swells, under voltage, over voltage and outages), distortions and frequencies [11-16].

The paper proposes an adaptive Web server application that tries to increase the performance of the Web server that hosts a Web site, as seen from the point of view of clients. The adaptiveness is based on the customisation of the Web site in a manner that emphasizes the interests of the clients.

Our server with dynamic allocation of client number is auto restarting. The usage of Web sites can vary widely during a day making difficult to predict the exact number of requests during any given time. Web server performance has a large impact on the popularity of a given Web site and therefore extensive effort has been done to improve it, especially for the sites that service a high number of

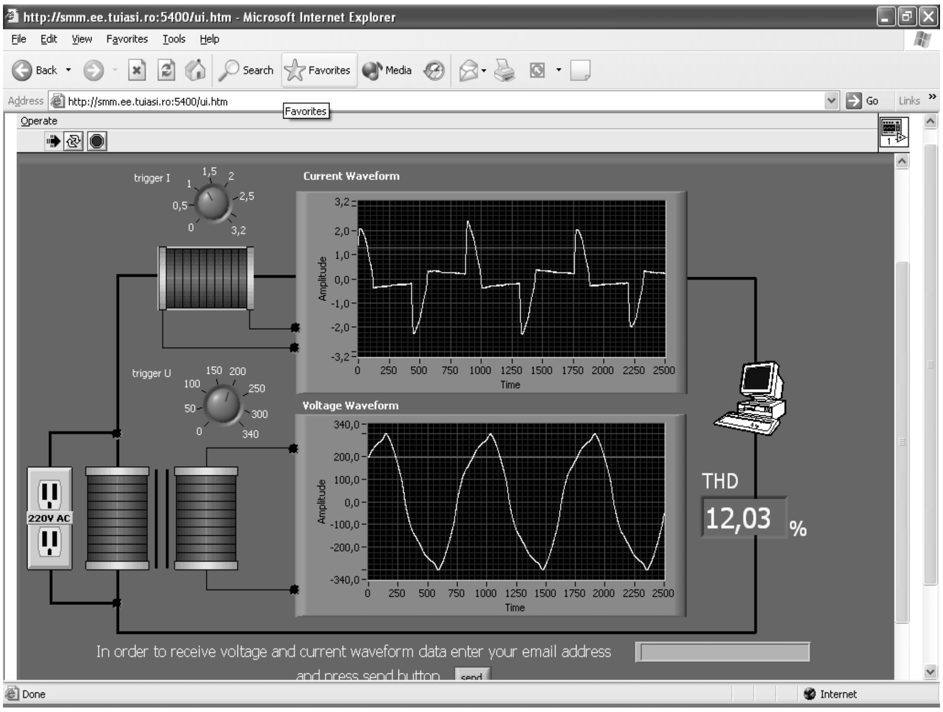

Figure 2. Virtual analyzer front panel

requests. To customize a Web site means to offer different versions of the site to different users. We divide users into classes, each class receiving a version of the site optimised to their requirements. The classification of the users is based on a wide variety of parameters including both capabilities of clients and server performance measures, as the clients perceive them. Some of the parameters used for the classification are: download time of Web pages, client’s bandwidth, the client’s connection type, Web server’s load the type of the browser’s plug-in components. The parameters’ values are stored in a centralized database situated on the server side. The classification information is computed at every access done by the user and therefore the class the user belongs to can be dynamically changed

III. Conclusions

A new distributed architecture for power quality monitoring designed end implemented, using a two server types. Users are required to use only a simple commercial Internet Web browser. The management of concurrence at the top hierarchical level uses dynamic allocation of client number.

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