Smart energy meter using Lab VIEW

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Abstract - Due to rapid increase in human population and the human's dependency towards electrical energy, the demand of electricity has increased, causing deficit of electrical energy during peak hours. Accurate metering, detection of illegal activities and implementation of proper tariff and billing system would manage the consumption of electrical energy. Collecting meter reading is one of the most difficult procedures in billing. The traditional electrical energy meter data collection is such that a person from the utility provider visits the consumer sites periodically to note the meter reading. This procedure has lot of drawbacks such as, it is time consuming, tiresome and requires more human resource and human error and even corruption is probable. Power management, giving them detailed information about power consumption. Although the implementation cost of Smart meters systems are high, their implementation will increase the revenue of the utility provider because of the following reasons, the working status of the consumer end meters can be identified remotely, eliminate the corruption by the human operator or the consumer and labor of meter reading is eliminated, integration of an apt tariff system with the smart meter reading data reduces the consumption of electricity during peak hours etc. Smart meters perceived to be a necessity rather than luxury in India.

Keywords - eliminated, implementation, consumer, Energy meter, Electrical Energy, LabView.

I. INTRODUCTION

A smart meter is an electronic device that records consumption of electric energy in intervals of an hour or less and communicates that information at least daily back to the utility for monitoring and billing. Smart meters enable two-way communication between the meter and the central system. Unlike home energy monitors, smart meters can gather data for remote reporting. Such an advanced metering infrastructure (AMI) differs from traditional automatic meter reading (AMR) in that it enables two-way communications with the meter. Communications from the meter to the network can be done via fixed wired connections (such as power line communications) or via wireless. In using wireless, one can opt for cellular communications (which can be expensive), Wi-Fi (readily available), wireless ad hoc networks over Wi-Fi, wireless mesh networks, low power long range wireless (LORA), ZigBee (low power low data rate wireless), Wi-SUN (Smart Utility Networks), etc. The term Smart Meter often refers to an electricity meter, but it also may mean a device measuring natural gas or water consumption. The process may be interrupted due to bad weather conditions, also if the consumer is not available, the billing will be pending and human operator needs to revisit. India is facing energy deficit during peak hours. Low voltage during peak hours has been reported as a major power quality issue. Load shedding is a common power management practice followed by the utility providers. Energy conservation has great significance in this scenario of increasing electrical energy demand. An Automatic Meter Reading (AMR) system equipped with advanced features like two-way communication, Time-Of-Day (TOD) tariff, etc. will address the problems of manual collection of meter data, energy deficit during peak hours and opens a channel for the consumers to participate in energy conservation.With development in technologies in the fields of communication and information technology, a wide variety of AMR and smart meters has been developed. A smart meter is an AMR with two-way communication infrastructure. Smart meters has been designed for various features like remote monitoring of energy consumptions, remote turn ON/OFF power supply, remote detection of energy theft, With time varying pricing system, remote fault detection, capable of monitoring power quality etc. Developments in information management and remote monitoring technology can play a vital role in energy management. Smart meter reading co-operate both utilities and consumers. Similar meters, usually referred to as interval or time-of-use meters, have existed for years, but "Smart Meters" usually involve real-time or near real-time sensors, power outage notification, and power quality monitoring. These additional features are more than simple automated meter reading (AMR). They are similar in many respects to Advanced Metering Infrastructure (AMI) meters. Interval and time-of-use meters historically have been installed to measure commercial and industrial customers, but may not have automatic reading. The UK consumer group, showed that as many as one in three confuse smart meters with energy monitors, also known as in-home display monitors. The roll-out of smart meters is one strategy for energy savings. While energy suppliers in the UK could save around £300 million a year from their introduction, consumer benefits will depend on people actively changing their energy use. For example, time of use tariffs offering lower rates at off-peak times, and selling electricity back to the grid with net metering, may also benefit consumers. The installed base of smart meters in Europe at the end of 2008 was about 39 million units, according to analyst firm Berg Insight.[9] Globally, Pike Research found that smart meter shipments were 17.4 million units for the first quarter of 2011. vision gain determined that the value of the global smart

meter market would reach $7 billion in 2012.Smart meters may be part of a smart grid, but alone, they do not constitute a smart grid.

II. NATIONAL INSTRUMENTS

National Instruments Corporation or NI

It is an American multinational company with international operation. Headquartered in Austin, Texas, it is a producer of automated test equipment and virtual instrumentation software. Common applications include data acquisition, instrument control and machine vision. National Instruments Corporation, or NI, is an American multinational company with international operation. Headquartered in Austin, Texas, it is a producer of automated test equipment and virtual instrumentation software. Common applications include data acquisition, instrument control and machine vision. National Instruments India was set up in 1998 to propagate the revolutionary Virtual Instrumentation technology in the country. Our consistent double digit growth and increased investments by NI in India is a testament to the success we have enjoyed in the adoption of Virtual Instrumentation technology in India. We understand the nuances and issues that Indian engineers and scientists face and have introduced various India - specific initiatives, to enrich the lives of Indian engineers. National Instruments believes in constant innovation and invests 16% of its annual revenue in Research & Development. National Instruments India has a Research and Development wing in Bangalore which helps customers across the globe. NI India R&D has received more than 7 patents for innovations in the fields of Motion Control algorithms, RF and software development.

Electronics Workbench Group

The National Instruments Electronics Workbench Group is responsible for creating the electronic circuit design software NI Multisim and NI Ulti board, which was previously a Canada-based company that first produced Multi SIM, and integrated ULTI board with it. Interactive Image Technologies was founded in 1995 in Toronto, Ontario, Canada by Joe Koenig, and specialized in producing educational movies and documentaries. When the government of Ontario needed an educational tool for teaching electronics in colleges, the company created a circuit simulator called Electronics Workbench. In 1998 the company started a strategic partnership with another electronic design automation company named Ultimate Technology from Naarden, Netherlands who was the European market leader in printed circuit board design software, with their package ULTI board. Like Electronics Workbench, founder James Post had focused heavily on the educational market and gained PR fame when he organized the distribution of 180,000 demo floppy disks via electronics magazines in Europe. In 1999 the companies merged, and renamed itself after its most well-known product, Electronics Workbench. The then current product line consisted of schematic capture and a simulation product named Multi SIM and the printed circuit board software

III. WHAT IS LAB VIEW

The name Lab VIEW is a shortened form of its description: Laboratory Virtual Instrument Engineering Workbench. Lab VIEW is a visual programming language: it is a system-design platform and development environment that was aimed at enabling all forms of system to be developed. Lab VIEW was developed by National Instruments as a workbench for controlling test instrumentation. However its applications have spread well beyond just test instrumentation to the whole field of system design and operation. Lab VIEW is a graphical structured dataflow language sometimes referred to as “G” - not to be confused with G-Code.

A. History Of Lab View

Lab VIEW was first launched 1986 as a tool for scientists and engineers to facilitate automated measurements - the aim was that it would be a tool that would be as productive for scientists and engineers as spreadsheets were for financial analysts. Says Jeff Kodowsky of National Instruments who came up with the initial idea and developed it ”We weren’t seeking to create a language but that’s what we ended up doing because we needed that level of flexibility and control in order to deal with the kinds of IO and processing required.” In addition to this, Kodowsky had been using an early Apple Mac which utilized graphics more than any other computing system. Kodowsky wanted to be able to utilize this capability to enable quicker programming of the control for instruments.

B. Labview Applications

LabVIEW provides a powerful platform for undertaking a wide variety of different applications. It started as an environment for managing test programming, but since its inception, the applications for which it can be used have considerably expanded. It has expanded from being a graphical test management language to become a graphical system design environment. This means that it can be used for an enormous variety of interesting and diverse applications. Not only can it be used for equipment control (including the control of the large Hadron Collider at CERN) and a variety of data acquisition applications (including car development simulation where Big Data monitoring is undertaken) to the system design arena where it has been used for development of projects from RF circuitry to biomedical equipment, green technology and much more.

C. Benefits Of Labview

It is a system-design platform and development environment for a visual programming language from National Instruments. The graphical language is named "G"; not to be confused with G-code. Originally released for the Apple

Macintosh in 1986, LabVIEW is commonly used for data acquisition, instrument control, and industrial automation on a variety of operating systems (OSs), including Microsoft Windows, various versions of UNIX, Linux, and macOS.

D. Interfacing To Devices

LabVIEW includes extensive support for interfacing to devices, instruments, camera, and other devices. Users interface to hardware by either writing direct bus commands (USB, GPIB, Serial) or using high-level, device- specific, drivers that provide native LabVIEW function nodes for controlling the device. LabVIEW includes built-in support for NI hardware platforms such as CompactDAQ and CompactRIO, with a large number of device-specific blocks for such hardware, the Measurement and Automation explorer (MAX) and Virtual Instrument Software Architecture (VISA) toolsets. National Instruments makes thousands of device drivers available for download on the NI Instrument Driver Network (IDNet)

IV. CODE COMPILING

LabVIEW includes a compiler that produces native code for the CPU platform. This aids performance. The graphical code is translated into executable machine code by a compiler. The LabVIEW syntax is strictly enforced during the editing process and compiled into the executable machine code when requested to run or upon saving. In the latter case, the executable and the source code are merged into a single file. The executable runs with the help of the LabVIEW run- time engine, which contains some pre-compiled code to perform common tasks that are defined by the G language. The run-time engine reduces compiling time and provides a consistent interface to various operating systems, graphic systems, hardware components, etc. The run-time environment makes the code portable across platforms. Generally, LabVIEW code can be slower than equivalent compiled C code, although the differences often lie more with program optimization than inherent execution speed.

V. CONCLUSION AND FUTURE SCOPE

Smart energy meter using Lab VIEW has been carried out with consumption patterns at .various levels. This can be extended to generation plants..It will be used in prepaid and postpaid energy meter.By using this we avoid voltage fluctuations and power theft..We regulate the maximum power consumption loads then automatically life span of natural source will increase. The home energy monitoring system has been developed to measure power consumption which helps to reduce the energy use in domestic areas through visible energy displays. Communication between Lab VIEW and consuming power module helped us to monitor the power consumption for plotting recent and historical data to optimize control and planning of energy consumption.

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