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An Approach on Energy Consumption Monitoring and Analysis System

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Abstract - *The energy audit begins from the survey at one end to one that may cover different phases. These phases cover a basic survey, next is the monitoring of energy use in the industry services, and then model analysis using computer simulation of industry operation. Energy audit plays important role in identifying energy conservation opportunities in the different industrial sector, while they do not give the final answer to the obstacle; they do help to recognize possible potential for energy conservation and suggest the companies to gather their efforts in this area in a convene manner. The difficulty of the audit is hence directly related to the stages or degree of composure of the energy management program and the cost of the audit exercise. Remote monitoring and control system points to a field of industrial automation that is arriving a new era with the advancement of wireless sensing devices. Remote monitoring of several industries sensors, machineries, energy are the most ambitious products and many organizations are working on it. The paper discusses the applicable solution in the industrial area and different research going through in order to enhance the system.*

Keywords: *EMS1, Remote Monitoring2.*

I. INTRODUCTION

The energy audit in a firm is a practicable study. For it not only serves to recognize energy use among the several services and to clarify opportunities for energy management, but it is also a critical first step in establishing an energy management program. The data will be produced by the audit plan, which such a program is based. The application should know to the owner, manager, or management team of the firm the options available for minimizing energy waste, the product costs, and the profits gained from implementing those energy-management opportunities (EMOs).

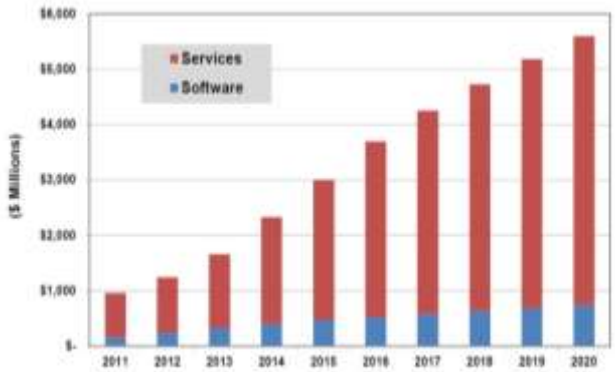

Chart -1: Industrial energy management software and service spending in United States.

The energy management programme is a systematic going through strategy for maintaining a room's energy consumption scenario. It is to reduce waste of energy, power and money to the minimum permitted by the climate the industry is located, its functions, occupancy timing, and other aspects. It generates and maintains an efficient balance between a room's annual functional and structural energy demand and its annual actual energy management.

Monitoring of electrical parameters is a important element in any energy path. Implementation of monitoring equipment is the first step of this kind of approach, as it makes a summary of the actual situation possible, before assurance of the most relatable answers. Because of monitoring it is possible to quantify the Energy Efficiency improvement tasks.

As the Energy Efficiency is consider, auditing of electrical energy is of obviously number one. Active energy (in kWh or MWh) is generally the measure of parts of the electricity bill. For an accurate analysis measurement of active energy is justify at several places in the installation, preferably at every workshop station. The measurement period should be limited, one week being a reasonable in order to compare periods with identical activity levels.

Any measure advancement of energy consumption should be analyzed, if it is not the result of a planned increase of activity level. The ideal situation should be a forward and extended contraction of energy consumption. Measurement of the supply voltage is also very crucial in terms of Energy Efficiency. Three different aspects should be taken into consideration:

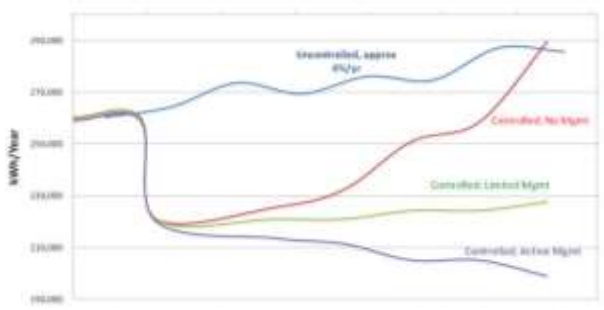

Fig -1: Advantages of Monitored and controlled active energy management

Amplitude should be measure for a moderate operation, the supply voltage should be control in a range of ±5% around the value specify by the Utility. Lower value means that some equipment like motors operate in deteriorated factors. Higher value means increased in power losses and distortion in transformers, motors, lighting equipment. Voltage fluctuations are responsible for light flicker and vibrations in motor, even if the voltage amplitude remains within the contractual limits. Voltage distortion and interruptions are the most crucial phenomena in terms of Power Quality. Accurate measurement and dating can help to find the source of the disturbance, and possibly facilitate negotiations with the Utility.

Current and Power absorbed at various points in the installation give the image of the instantaneous activity level. Observation of big distortion and fluctuations of current or absorbed power can direct actions in order to regulate equipment and accurate energy usage. Continuously large values of current and power mean that overload tripping is likely and low values means that rating of equipment may be unsuited.

Power Factor and Harmonic distortion are other crucial indicators of the way electrical installations are managed. If Power Factor has less than 0.9, means that the supply current is un-necessarily gained, for a given power transmitted to the loads, and subject to a advance charge by the Utility. Power Factor Correction equipment should be implemented.

High harmonic voltage regarding distortion should be higher than 6 to 8%, may be the reason of disturbances and increased power losses. This observation may have started the implementation of harmonic mitigation equipment. For big interconnected networks, the power factor, frequency is maintained by the Utilities within strict deadlines of 50 or 60Hz. There is not anything to be taken as acknowledge at the Distribution level. The only actions to be seized in case of measurement showing out-of-range frequency have to be preparing for interruption or black-out!

Voltage unbalance aspect is another parameter which is commonly monitored and displayed without being under control. Fortunately, this is generally not a problem in most electrical installations.

1.1 Energy Management System

EMS is a pc-based platform technique used for the analysis and monitoring of our energy usage. The system enables you to observed and to analyze your power usage from different requirement by easy way. System features consist energy use, users demand, Power W-VAR-VA and more. A multitude of reports can then be generated so as to fully understand and assess how can be power is utilized within our property.

Fig -2: System diagram of EMS

Fig.2 Explains the system diagram of EMS (Energy management system), where it gives the flow of the system data transfers and the connection schematic. Complete EMS consisting following components,

- ***Multifunctional Energy Meter:*** these meters are uniquely designed for the industry demands and it involve of micro processing capabilities which can count the various energy parameter like amps, watt, volts, etc. from incoming phase. These meters can be communicated through various communication protocols such as Modbus, serial to take the parameters values to system.
- ***Data Logger / Communicator:*** These components permit energy meter to transfer data to centralized system or communicate with remote system to share the data.
- ***Monitoring Software:*** This software will collect the data from energy meter and allow user to monitor, plot graph or make an analysis report for future use.

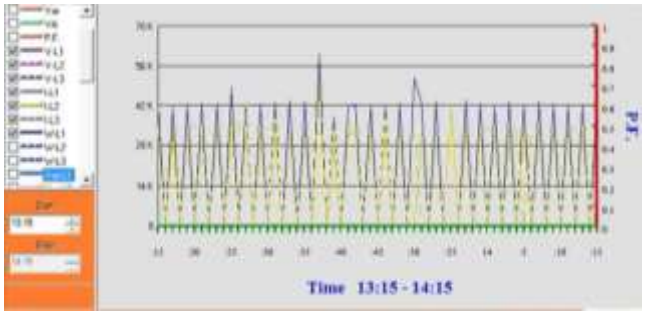

Fig-3 Analysis report

Fig. 3 shows the typical graphical visualization of different energy parameter and its values from specific node or the energy meter. These parameters value normally counted by energy meter itself. Monitoring software will only log and generate those values.

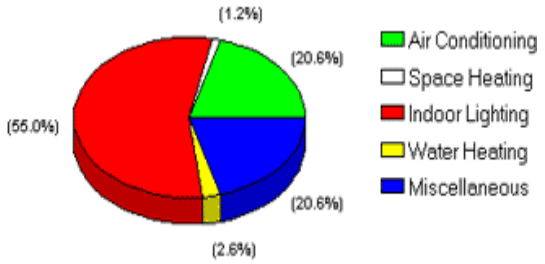

Fig. 4 Analysis report of individual device group energy consumption.

II. LITERATURE SURVEY

The use of Internet and technologies has been rapidly spreading and previous systems has been replaced with new systems based on these advance new technologies. At changing environment of the power industry, in 1999 Toshiba introduce a concept of new middleware for power system network control systems including (EMS) energy management system, (SCADA) supervisory control and data acquisition system, and (DMS) distribution management system. This new concept pattern is based on latest Internet and technologies, offering the real-time operation, high reliability and control management required for network control system. Many systems are being manufactured, and some of which are at the stage of production test.

P. Thamarai, R. Amudhevalli [1]. Proposed a system which deals with the problem in a simple and effective way by evaluating the use of energy in the different industrial area. It checks power shutdowns by analyzing a large amount of energy wasted in industries by performing all this in an automated process. Energy Meters, PLC's and PC's SCADA- Supervisory Control and Data Acquisition of industrial management processes used for serial communication to facilitate communication between the programmable logic controllers and computer

Hong-Chan Chang and Cheng-ChienKuo [2]. proposed the (EMS) energy momitoring system which uses the communication environment of ZigBee wireless sensor network device in combination with the control functions of safety protection and the energy parameters measurement and monitor, to achieve the objectives of energy saving, carbon reduction and safe power usage. The system structure design is consisted of wireless transmission module, the intelligent outlet module, and central monitor and control module.

Adnan Rashdi, Rafia Malik, Sanam Rashid, Anam Ajmal [3]. Presents the design of a GSM based energy monitoring system, control and profiling system. The system design integrates energy meters installed at consumer unit with an electric supplier company's energy monitoring system (EMS). Single phase digital electric meter can be used with intelligently developed on transmission module, which takes the meter reading and utilizes the GSM network to transmit the energy reading using Short Message Service (SMS) back to the energy supplier. At the supplier end, an energy monitoring system is used to manage and control all received meter readings, compute the billing cost, update the database and maintain an energy consumption database profile for each user. Various alerts and control can also be generated by the supplier.

Anbarasu.M1, Rajendhiran.V2 [4]. Proposed a system which identifies the similarities between wireless sensor networks (WSNs) and electrical- signal-based motor signature analysis and proposes a scheme of using WSNs in web based system and fault diagnostics and remote energy monitoring for industrial motor systems. The main idea is to provide a system overview where the nonintrusive nature of the electrical-signal-based motor signature analysis enables its applications and features in WSN architecture. Special considerations in designing nonintrusive motor energy monitoring and fault diagnostic methods in such systems are discussed.

III. PROPOSED SYSTEM

Proposed product is a web based communicator module useful in remote monitoring of energy meter. The product divided in to multiple module including software and hardware building. Main concept of communicator is to work with existing supportable meter and transmit it's reading over the internet at any location following are some modules involved.

Hardware

Energy meter: It will be any existing energy meter which much supports Modbus protocol based communication with host system like computer, PLCs or the microcontroller. These meters could be RS232, RS485 or TTL communication based. These meters will transfer different voltage and current information over the communication media.

Controller Unit: Main logic and control board will be based on AtMega Serial microcontroller which will take care of the entire decision making and the conditional execution of different processes and work as a forwarder between web-based data logger and the energy meter. Main unit will also handle internal memory management for setting parameter reading and writing. This logic board will manage following modules

Serial Convertor: as the energy meter communicate over serial interface like RS485 or the RS232 so this data could not be readable to microcontroller hence in order to make it readable to microcontroller system needs to convert the signals in TTL format. This can be achieved using max485 or the max232 like serial convertor boards.

GPRS Module: For communicating with the remote web server system needs internet connection or the data connection. This connection could be available to microcontroller using GRPS module. With the help of different AT+ command set supported by the GPRS modem, microcontroller will send the energy meter reading to central server. This module will work as a web client. It will send parameter to web server as a web request and web server will then send a response to the meter and meter will act upon.

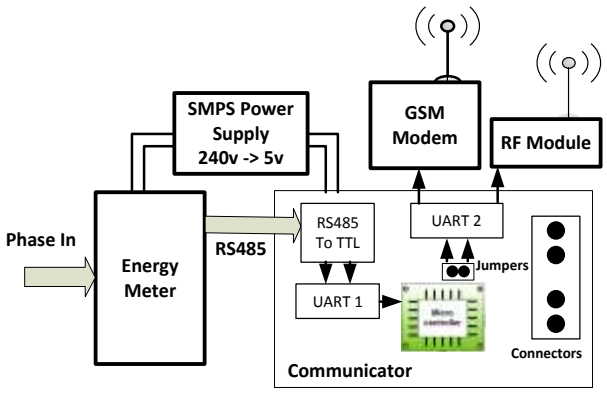

Fig. 5 Communicator module overview

Software

In order to control and monitor the communicator system need to deal with series of software which will internally communicate with each other and all software must follow some standard formulations. Fig. 3.0 will describe the series in detail.

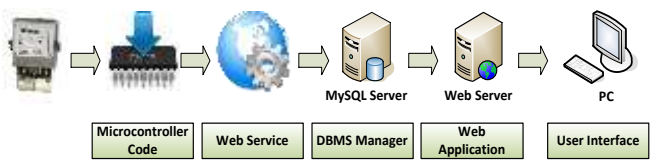

Fig. 6 overview of interdependent software chain

Microcontroller program: This code specifically designed for AVR series microcontroller which will control overall working logic of the communicator

Web Service: This is dedicated IP based central web service, which will get accessed by

Software User Interface: End user windows based software application for accessing the meter reading from database and plot the graphs and trends for analysis purpose

IV. CONCLUSION

As the energy auditing is need of industries in order to save unnecessary energy consumption and to know the exact specification of requirement of every device or the machine, hence the proposed system is this development at next level by enhancing th[illegible] IoT (internet of things) for industrial remote energy parameter monitoring system. The advantages of wireless sensor node over traditional sensing have made them a promising platform for remote monitoring systems. The objective of energy audit is to identify the end use of energy in industry, and as a feasibility study leading to implementation of an energy management program. The audit procedures can be expanded as needed in the various phases of the energy program, with the application of each succeeding phase yielding more information on energy use, and more opportunities for raising energy efficiency.

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