DEVELOPMENT OF WEB BASED ENERGY MANAGEMENT SYSTEM

[1]VINAY K.S, [2]H. RAMAKRISHNA

[1]Assistant Professor, industrial engineering and management, DSCE Bangalore - 560078.
[2]Professor and Head of industrial engineering and management, DSCE, Bangalore.
E-mail: [1]vinaysgv2008@gmail.com, [2]hrkrishna1963@gmail.com

Abstract- The usage of electrical power at home or Organization is something that always occurred in our life and it was a necessary to manage it in a systematic way to ensure the system operate in intelligent mode. In India when users at home turn on the electrical appliances in peak time which contribute to the exceeding of limit power drop causing them to be charge in expensive rate. The purpose of this project is to design a web based control system to meet the objectives of monitoring the consumption's rate of power, current level, and turn on or off appliance through a computer. Methodology in implement this system could be categorized into Statistical Analysis and Software Design. The software develops based on graphical user interface in PHP a web based open source software which is interface with hardware that used Energy Meter with Motorola microcontroller as controller. Energy management system implementation ultimate goal is to achieve through intelligent system integration of existing systems be saving energy consumption and improving its efficiency

Keywords- Energy saving, smart home, Statistical Tools, Correlation, Regression,

I. INTRODUCTION

The Energy used by any business varies as production process. Energy efficiency is a measure of energy used for delivering a given service. Improving energy efficiency means getting more from the energy that we use [1]. Operating costs related to heating, cooling, and electricity can be controlled only through the proper management of the overall utility infrastructure and effective energy conservation practices. Among several low/no cost energy savings, Monitoring Targeting is a proven method for measuring and maintaining energy performance, and for identifying opportunities to improve energy efficiency.

II. OBJECTIVE

The objective of this project is:

(i) To create a web based statistical tool that constantly monitors the power consumption by each appliance and communicates the data to the user in easy manner

(ii) To allow the user to control the appliances through a PC and also the system able to work independently base on the program that been set in control unit to be automatically react to the data such in order to manipulate the energy consumption patterns.

III. SCOPE OF PROJECT

- Develop a GUI using PHP and Minitab for hardware and software interfacing.
- Designing on microcontroller MC68HC11 in expanded mode as control unit

and optimize the usage of features that exist in that microcontroller such as

serial communication (SCI) and analog to digital converter (ADC).

- Automating software to generate results and make it available for users.
- Making software to access even from mobile phone. so can be connected very easily and monitor the energy consumption

IV. LITERATURE REVIEW

Development of web based energy management system is a development of a control system to monitor the power usage. This system could be classified as supervisory control system where the PC is used to monitor the usage of energy. However, the PC only receive the measured value of voltage and current, then user can interface with PC to determine the set point to be sent to the microcontroller. From here user was able to manage the usage of energy

at home in systematic ways and the system uses correlation and regression tools to develop the CUSUM Analysis and reports to the users in daily and monthly details and can supply a homeowner with the necessary information that allows the homeowner to adjust the usage of individual appliances. As referring to the below statement:

A PC based energy management system associated with automatic meter reading and various load control functions for load management (Ming Yuan Cho, Cha Win Huang, May 2001). [2]

Thus, the development of this project is coincidence with the statement where the system is function to be as meter for current, voltage and power reading and especially for management of various load at home.

In certain countries, the utility's company determined different rate of charge per kilowatt-hour (kWh) when homeowner is consuming energy during periods of high demand. As referring to this statement:

Manitoba Hydro provides electrical energy at a fixed rate, but in many other countries utility companies

charge variable rates for energy, charging more per kilowatthour (kWh) during periods of high demand. [3]

BC Hydro 2007, in partnership with industry energy experts, undertook a pilot project to understand the opportunity for an M&T program. As BC Hydro has designed a program that provides expertise and funding to help industrial customers implement a tailored M&T program. The resulting program design supports an incremental approach by helping industrial customers understand the value of M&T, build internal support, and then implement M&T, through the following five stages:

- Custom Illustration
- Custom Workshop
- Operational Energy Analysis
- Implementation
- Continual Improvements

The overall purpose of the pilot investigation was to feed the development an M&T DSM program. The goal of the program is to assist customers in implementing their own MT&R process for the purpose of improving the performance of their operations and reducing their energy consumption [4].

V. DESCRIPTION OF PHANTOM LOADS

Phantom Load also called Standby power; phantom load refers to electricity consumed by electronic appliances while they are switched off or in Standby mode.

Many household appliances are never fully switched off, but spend most of the time ready to be turned on again. A Lawrence Berkeley National Laboratory Study estimated that stand by power consumption accounted for approximately 5 percent of the total residential electricity used.

To calculate how much these stand by devices add to your electricity usage and energy bill multiply the number of appliances you have by the annual cost.

Table 5.1 Stand by Devices energy Calculator

Appliance	Average annual energy use in Standby mode[kWh]	Average annual cost	X	Number of Appliances in your home	=	Your Annual Cost
Cable/Satellite boxes	128	684.8				
CRT TV[27"]	26	139.1				
Computer	16	85.6				
Printer	70	374.5				
Router/Modem	16	85.6				
Clock Radio	18	96.3				
Garage door opener	24	128.4				
LCD TV[27-40"]	123	658.05				
Microwave oven	26	139.1				
LED/3D TV[50"]	145	775.75				
Rear Projection TV[52-65"]	186	995.1				
Stereo/Surround Sound	128	684.8				
DVD/BR Players	59	315.65				

A. Measures taken to Reduce Phantom Energy Use

Some of the measures taken to Reduce Phantom loads are

- Consolidate- Consider on Refrigerator or Freezer instead of two.
- Unplug battery chargers for cell phones, power tools and other electronic equipment when not in use.
- Use a power strip with a shutoff switch for TV's and other Players that are not regularly used.
- Turn off computers, Scanners, Printers and other office equipment's when not in use. Set computer to "Hibernate "to help conserve energy.
- Remove loads that are not needed. If you have one or more night lights, then remove the ones you don't need.
- Purchase Energy Star products
- Use CFL or LED Bulbs wherever possible.

B. Green Power /Renewable resource programs

This is most evident by the success of Green Power EMC, a non-profit cooperative that was formed to promote green power from Georgia-based renewable resources. 39 Georgia EMCs participate in Green Power EMC, accounting for approximately 283 million kilowatt-hours produced from a variety of renewable resources since October 2003. These resources include landfill gas-to-energy projects, a low-impact hydro facility, a biomass generation plant, a solar generation project, and many solar demonstration projects. Currently, Green Power EMC's renewable resource portfolio encompasses a

total output of approximately 23.42 MWs and represents the largest voluntary green power program in Georgia. [6]

VI. WORKING OF ENERGY MANAGEMENT SOFTWARE (EMS)

Software is based on principles of statistical process control and energy accounting. It involves four key information management techniques [3]:

- Data and Information
- Energy Performance Model
- CUmulative SUM [CUSUM] Analysis
- Energy Performance control charts

First Microcontroller based Energy meter will collect the readings and same is fetched by software. Software then interprets the data using statistical tools and produces results which can be easily accessible by users.

VII. BENEFITS AND BARRIERS OF USING EMS

- This tool can provide the following benefits to organizations: EMS is a useful tool to not only track energy use but to control it. Industry may gain improved insight into their operation through Open source [7].
- EMS is a useful way of turning data on energy use into useful information that can lead to significant energy and cost savings. A reasonable savings range is between 1 and 5% achieved through CUSUM Analysis.
- It showed that if the best performance periods could be replicated, savings of 4% would be achievable.

CONCLUSION

EMS can significantly reduce energy bill and increase productivity through identification of best practice opportunities in site utilities and processes, assessment of behaviors & practices and monitoring & targeting strategies.

- Lower balancing power and cost.
- Higher energy efficiency and reduced carbon footprint
- Detect waste early to minimize losses
- Identify best performance for target setting
- Identify bad performance for corrective action

BIBLIOGRAPHY

[1] B. Kim, S. Hong, Y. Jeong and D. Eom, The Study of Applying Sensor Networks to a Smart Home, Power Systems Computation Conference (PSCC), Sevilla, 2428 June 2002

[2] http://get-fuse.com/home automation.php

[3] R. Robles and T. Kim Applications, Systems and Methods in Smart Home Technology: A Review, International Journal of Advanced Science and Technology, Vol. 15, February, 2010.

[4] C. Bjorkskog , Human Computer Interaction in Smart Home, available on: http://www.hiit.fi/~oulasvir/58307110/smarthomes.pdf

[5] http://www.id.carleton.ca/ web/ student %20 papers %20PDF/ inclusive %20technology / Isaza Shelton_ Diana_ SeminarPaper08.pdf

[6] M. Kawidean, M.Kassim, design development and implementation of smart home systems using RF and power line communication , The 2nd National Intelligent Systems And Information Technology Symposium (ISITS'07), Oct 30-31, 2007,ITMA -UPM, Malaysia.

[7] Dale R. Patrick Stephen W. Fardo Ray E. Richardson Steven R. Patrick "Energy Conservation Guidebook", Second Edition, CRC Press

★★★