ISSN XXXX XXXX © 2018 IJESC

Research Article Volume 8 Issue No.3

Smart Energy Meter for Advanced Metering and Billing Alert Framework

R.Asha[1], R.Aruna[2], J.Divya[3], K.Balasaranya[4]
B.Tech Student[1, 2, 3], Assistant Professor[4]
Department of Computer Science and Engineering
R.M.D Engineering College, Affiliated to Anna University, Chennai, Tamilnadu, India

Abstract:
Demand Side Management (DSM) will play a significant role in the future smart grid by managing loads in a smart way. DSM programs, realized via Home Energy Management (HEM) systems for smart cities, provide many benefits consumers enjoy electricity price savings and utility operates at reduced peak demand. In this paper, Evolutionary Algorithms (EAs) (Binary Particle Swarm Optimization (BPSO), Genetic Algorithm (GA) and Cuckoo search) based DSM model for scheduling the appliances of residential users is presented. The model is simulated in Time of Use (To U) pricing environment for three cases: (i) traditional homes, (ii) smart homes, and (iii) smart homes with Renewable Energy Sources (RES). Simulation results show that the proposed model optimally schedules the appliances resulting in electricity bill and peaks reductions.

Keywords: Appliance Scheduling, Binary Particle Swarm Optimization Genetic Algorithm, Cuckoo Search Algorithm, Energy Management System, Electricity Pricing, Smart Grid

I. INTRODUCTION

Electricity is the driving force behind the development of any country. With the rapid increase in residential, commercial, and industrial consumers of electricity throughout the world, it has now become imperative for utilities companies to devise better, non-intrusive, environmentally-safe techniques of gauging utilities' consumption so that correct bills can be generated and invoiced. In the Internet of Things (IOT) model, many of the living and non-living things that encompass us will be on the internet in one form or another. Driven by the popularity of gadgets empowered by wire-less technological innovation such as Wireless Bluetooth, Radio Frequency Identification, Wireless-Fidelity, embedded sensor, IoT has moved out from its beginning stage and it is actually on the edge of changing the present fixed inter-net into a well featured upcoming Internet. Currently there are almost nine billion inter-connected gadgets and it is estimated to touch almost fifty billion gadgets by 2020. There is incorporation of mobile technology into MSEB automation system due to the rapidly advancing mobile communication technology and the decrease in costs. We propose a system that collects the energy consumption from residential as well as corporate zones and send it directly to the central server where processing is done on that data for preparation of bills. AMR system can be divided into wire AMR system and wireless AMR system according to communication medium used. In existing system for collection of energy consumption data is that the representatives of MSEB monthly comes and visit every residential, take the snap shot and corporate and manually reads the consumption data from the meter. This collected data is recorded on a piece of paper along with a snap shot of the meter and finally submitted to the local MSEB office. There after the official's read the snap shot and meter readings and then gives it to the local software for bill calculations and generation of bill. We as a consumer then make the payment for the received bill. This process is so much hectic process. Man made mistakes can be countless. Human resources wasted and many other problems do occur. We finally thought of building a system that will do the above process automatically. Microcontroller is attached with our traditional energy meters that will scan the meter reading after particular period. Wirelessly, these meters reading will transmitted to the centralized server along with their unique meter number. This data will be processed by the server and automatically generates the bill. After generation of bill it will send to every consumer via SMS facility.

11. LITERATURE SURVEY

TITLE1:PRIVACYPRESERVING
ENERGY THE FTD ETECTION IN SMART GRIDS: A P2P COMPUTING APPROACH
AUTHOR: S. Salinas, M. Li, and P. Li
YEAR: 2012

DESCRIPTION:

In the U.S., energy theft causes about six billion dollar losses to utility companies (UCs) every year. With the smart grid being proposed to modernize current power grids, energy theft may become an even more serious problem since the "smart meters" used in smart grids are vulnerable to more types of attacks compared to traditional mechanical meters. Therefore, it is important to develop efficient and reliable methods to identify illegal users who are committing energy theft. One of the most salient features of smart grids is the replacement of conventional analog mechanical meters by digital meters, usually called "smart meters". In addition to recording users' energy usage, due to their communication capability, smart meters can provide a two-way communication path between UCs and energy users, which can facilitate efficient power system control and monitoring. However, compared to mechanical meters which can only be physically tampered, smart meters are vulnerable to more types of attacks (e.g., network attack), which may make energy theft easier to commit and hence an even more serious problem in smart grids. The three algorithms are distributed algorithms and are based on LU or QR decomposition. We can observe that no private data from any user needs to be transmitted to other

users or to the collector, which cannot were covered either, thus preserving users' privacy. We have also analyzed the computational and communication complexities of the proposed algorithms, and find that QRD has higher computational complexity and higher communication complexity compared to LUDP.

MERITS:

When an illegal user commits energy theft, it is possible that the rate at which he/she steals energy is variable

DEMERITS:

An illegal user may impersonate his/her own SM and make it record lower energy consumption.

11. EXISTING SYSTEM:

- No advanced technology for measuring the reading of electric bill in home's
- Human s are placed for take readings from home
- electric bill are not maintained properly
- higher supply needs have to be met by the increment of energy production
- we can't control power limit to homes and industries

Disadvantages OF THE EXISTING SYSTEM

- Human need is required.
- Electric bills are not maintained properly.
- Can't control the electricity limit in industries and homes.
- Power theft maintenance scheduling billing are not addressed properly

A. Conceptual model:

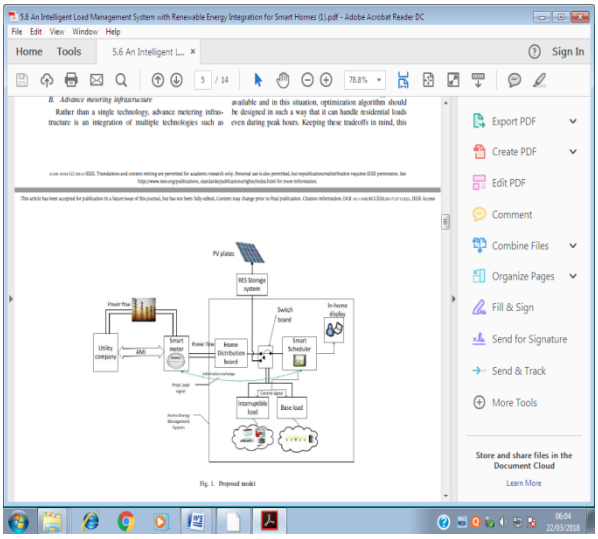
Show a graphical representation of the proposed model that serves as the basis for the development of optimization algorithm. It consists of integrated power & renewable energy utility that is interested in serving all types of residential or commercial loads. The respective power grid and on-site RES act as a single node.

The optimization program dispatches power to residential loads and storage system that could be utilized during high demanding hours. The energy demand of residential load is directly fulfilled by using grid energy, direct renewable energy or storage systems depending on the electricity price in particular hours. However, the onsite renewable energy source and storage system act as a "first-choice" for delivering energy to residential loads.

In this way, the load management system reduces the energy obtained from utility which is presented and discussed in section V. Furthermore, the integration of on-site renewable energy and storage systems with HEM model is helpful in reducing high peaks on grid when energy demand is high.

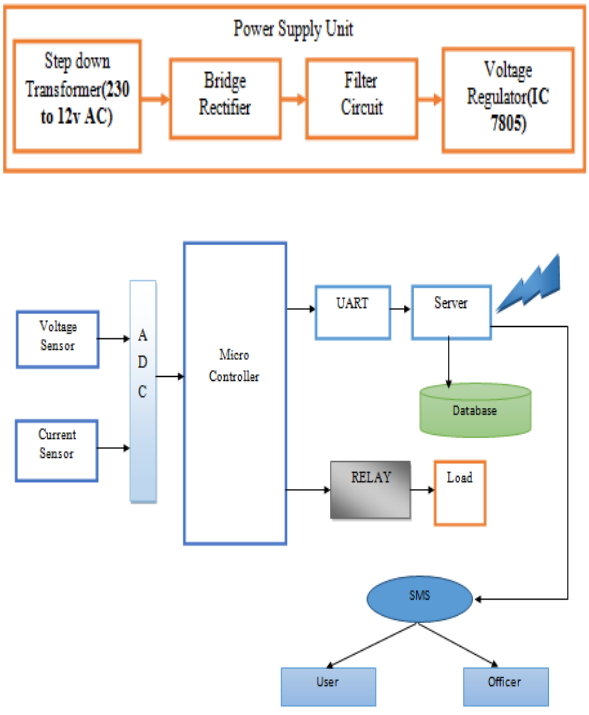
B. Advance metering infrastructure :

Rather than a single technology, advance metering infrastructure is an integration of multiple technologies such as smart metering, home area network, Software



Inter faces, and data management applications. Along with these technologies, two way communication, sensors, and distributed computing make it feasible for both end users and independent system operators. The system composed of these technologies leads to make intelligent decision making, reliability, safety and ease of use [41], [42]. Regarding home area network, system includes smart meters, communicating thermostats, back-haul communication network, data centers, and data integration into new and old application platforms. According to Fig. 1, smart meter is located between home area network and utility which forwards aggregated load demand to utility via smart meter. Then based on load data, utility calculates and provides pricing signal

III. BLOCK DIAGRAM:



IV. PROPOSED SYSTEM:

Renewable energy integration is done

- advanced smart metering system for measuring and controlling the electricity
- Monitoring the current and voltage through sensors for each device

- Consumes less power and high efficiency.
- If any user uses more electricity, indication will be send and power will be cut off for certain time
- Voltage and Current sensor is placed for measuring the voltage and current state of the EB meter
- we can avoid the wastage of power and power saving will takes place
- A Web server facility is provided for monitoring and control using PC

ADVANTAGES OF PROPOSED SYSTEM

- No man power need for taking current readings.
- Avoid high usage of electricity.
- Can identify the high electricity used industries easily

HARDWARE REQUIREMENTS:

- Microcontroller
- ADC
- UART
- Voltage Sensor
- Current Sensor
- PC
- Relay
- Power supply unit
- Processor : Pentium Dual Core 2.3GHz
- Hard Disk:500 GB or Higher
- Ram :2 GB (Min)

SOFTWARE REQUIREMENTS:

- Operating System : Windows 7 or Higher
- Languages used :Java (JSP, servlet), HTML

MODULE DESCRIPTION

- User Interface
- Analog measurement circuit
- Transmitting and receiving
- Data Storing
- Web application

User Interface:

In the industrial design field of human–machine interaction plays an important role. It is the space where interaction between humans and machines occurs. Its goal of interaction between a human and a machine at the user interface is effective operation. Input allowing the users to manipulate a system. The user will perform either login or registration operation. After this operations get over he will go to the next phase. This allows the new user to register and open the application to the browser. This helps to monitor the actions that are happening in the home meter that could be traced by the officer and user. This ensures the security credentials so that issues that occur can be easily resolved. The registration can also be done by means of personal id also which is highly useful for illiterate people. This can be directly used by the user or officer by just typing their id in that text fields.

Analog measurement circuit

Our main goal is to measure the power use of electronic equipment. ACS712 current sensor is connected between supply and load to measure the current flowing through load. This current sensor is based on the principle of hall-effect. The principle states that whenever current carrying conductor placed in magnetic field, the voltage is created across its edges perpendicular to the direction of both current and magnetic field. The voltage generated is called as Hall voltage which is in micro volts. Proposed block diagram it is directly proportional to the current and magnetic field. ACS 712 current have inbuilt signal conditioner and filter circuit stabilizes and amplify the induced Hall voltage to an appropriate level. The ADC channel of microcontroller reads the measured current values. The measured data is send to controller for further calculation. Relay is used for controlling action (e. g. on/off) of the electronic equipment. Relay circuit receive control signal from Arduino

Transmitting and receiving

When that device is in the range of data reception it will receive the data sent by transmitter in the load side meter. For this one counter has to be installed in the Arduino. It will keep a record of power consumed by load over a given time (say one month).This recorded data will be send by transmitter UART. Receiving device will receive the meter reading and keep its record with consumer serial number. For this device should be in the range of transmitter. Hence, utility company personnel don't have to check every meter. He can take reading without going to consumer's house.

Data Storing

The human intensive work is avoided and all the values are maintained in the central server. The communication medium is secure and tampering of energy meters can be identified easily. If an error occurs in the system, the value in the central server will not be updated. Once the value updated crosses the threshold time, the server can determine that something is wrong in the system and can report the engineers in EB.

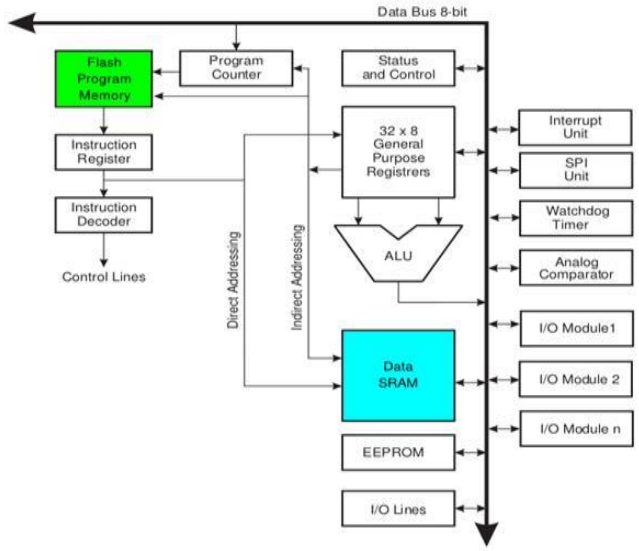
Web application

Since IOT is cost effective compared to SMS, monitoring of energy meters at lower cost is made possible. Daily consumption reports are generated which can be monitored through application and/or web portal. Also, users can see their electric bills from their web application.

V. ARDUINO ARCHITECTURE:

Arduino's processor basically uses the Harvard architecture where the program code and program data have separate memory. It consists of two memories- Program memory and the data memory. The code is stored in the flash program memory, whereas the data is stored in the data memory. The Atmega328 has 32 KB of flash memory for storing code (of which 0.5 KB is used for the boot loader), 2 KB of SRAM and 1 KB of EEPROM and operates with a clock speed of 16MHz.
The most important advantage with Arduino is the programs can be directly loaded to the device without requiring any hardware programmer to burn the program. This is done because of the presence of the 0.5KB of Boot loader which allows the program to be burned into the circuit. All we have to do is to download the Arduino software and writing the code.

Arduino Uno consists of 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button



VI. CONCLUSION AND FUTURE WORK:

This paper presented a new HEM model based on To U pricing scheme with and without RESs. In order to optimally consume grid and RES energy, the proposed model used EAs BPSO,G and Cuckoo. The results obtained from the simulations revealed that cost saving is achieved in terms of minimized user electricity bill. By using BPSO, GA and Cuckoo algorithms, the proposed model significantly reduced the electricity bill and high peaks. From table VI, it can be concluded that with and without RES, Cuckoo search algorithm provides better results (6.93%, 43.10 %) in comparison to GA and BPSO. In the future, we will investigate other optimization techniques for further reducing the electricity bills of end uses

VII. REFERENCES

[1]. S. Salinas, M. Li, and P. Li, "Privacy-preserving energy theft detection in smart grids," in Proc. IEEE Communications Society Conf. Sensor, Mesh and Ad Hoc Communications and Networks (SECON), Seoul, Korea, Jun. 2012, pp. 605–613.\

[2].F. Li and B. Luo, "Preserving data integrity for smart grid data aggregation," in Proc. IEEE Int. Conf. Smart Grid Communications (Smart- GridComm), Tainan City, Taiwan, 2012, pp. 366–371.

[3]. F. Li, B. Luo, and P. Liu, "Secure information aggregation for smart grids using homomorphic encryption," in Proc. 1st IEEE Int. Conf. Smart Grid Communications (SmartGrid Comm), Oct. 2010, pp. 327–332.

[4]. Y. Kim, E. Ngai, and M. Srivastava, "Cooperative state estimation for preserving privacy of user behaviors in smart grid," in Proc. IEEE Int. Conf. Smart Grid Communications (SmartGridComm), Brussels, Beligium, 2011, pp. 178–183.

[5]. S. Depuru, L. Wang, V. Devabhaktuni, and N. Gudi, "Smart meters for power grid; challenges, issues, advantages and status," in Proc. IEEE/PES Power Systems Conf. Expo. (PSCE), Phoenix, AZ, USA, Mar. 2011, pp. 1–7.

[6].G. G. Rigatos, "Particle filtering for state estimation in nonlinear industrial systems," IEEE Trans. Instrum. Meas., vol. 58, no. 11, pp. 3885–3900, Nov. 2009

[7.]C.-C. Lai and Y.-C. Chen, "A user-oriented image retrieval system based on interactive genetic algorithm," IEEE Trans. Instrum. Meas., vol. 60, no. 10, pp. 3318–3325, Oct. 2011

[8].M. A. Douar, A. Mekhaldi and M. C. Bouzidi, "Flashover Process and Frequency Analysis of the Leakage Current on Insulator Model under non-Uniform Pollution Conditions", IEEE Trans. Dielectrics and Electrical Insul., Vol. 17, No. 4, pp. 1284 -1297, 2010.

[9].M. A. Douar, A. Mekhaldi and M. C. Bouzidi, "Frequency analysis of the leakage current under non uniform polluted conditions on one insulator plane model", IEEE Conf. Electr. Insul. Dielectr. Phenomena (CEIDP), pp. 1-4, 2010.

[10].T. Edeler, K. Ohliger, S. Hussmann, and A. Mertins, "Super-resolution model for a compressed-sensing measurement setup," IEEE Trans. Instrum. Meas., vol. 61, no. 5, pp. 1140–1148, May 2012