

IOT BASED E-BILLING AND E-AUDITING

Devi Subramanian¹, Dr. N. Suma²

¹ Devi Subramanian, PG student, Dhanalakshmi Srinivasan college of Engineering, Coimbatore

² Dr. N. Suma, Professor, DSCE, Coimbatore-641 105

Abstract - The paper presents the design and implementation of an IoT (internet of things) based electronic billing and electronic-auditing (e-auditing) system to provide an easier and more reliable method for billing from any area of the world using internet, and perhaps to ensure the auditing procedures of the daily consumed electricity, The proposed system works on the real time monitoring on the power management by knowing usage time to time. It provides a systematic routine for the customers to remind them to pay the bill on time with an SMS alert on correct schedule, or else the electric power connectivity can be turned off autonomously from the distant host i.e. the created web page using, Dot NET and # C .Daily consumption reports as well as a comparison of the previous month and present month average is displayed on web portal page as well as SMS alert. In order to save energy all over the designed system is concentrating on the automation of electronic devices based on the visitor counter, using sensors.

Key Words: Internet of thing (IoT), power consumption, smart devices-auditing-billing.

1. INTRODUCTION

The IoT stands for internet of things, it may be defined as network of "things" or various applications connected to a common network path in order to communicate, as well as exchange data or control each other. So IoT has become the host and most important subject in current digitalized world since it promises to be most reliable method in the internet connectivity for all kinds' devices and physical objects (analog and digital devices). The studies held over the digitalized devices have proven the functionality of IoT, to modify the shape of living by ensuring cost effective living including safety, security and entertainment. The studies held over the digitalized devices have proven the functionality of IoT, to modify the shape of living by ensuring cost effective living including safety, security and entertainment.

In today's rising technology, there is growing demand of automation and intelligent systems, which directly and indirectly leaves us with less human intervention and excellent decision making devices. IoT has an well maintained purpose on the daily electronic home appliances which can regulate over lights, heat, AC etc. turning them on and off as we enter and exist rooms, as a result it gives a perpetual effects to save money on energy use, while keeping your office and building comfortable.

In this paper we are introducing an IoT based energy meter.

Old GSM technology in the existing system domestic energy meter reading has been replaced with Internet of things in the basic energy meter by, universally exist a variety of technical problems such as difficulty in construction, narrow bandwidth etc and no two way communication and tragic billing system. In the IoT based energy meter the power variations occurring in the microcontroller can be measured using voltage and current sensor.

From the IoT based energy meter the billing details are communicated with the consumer via GPS or a 3G/4G attached sim and finally displayed in the created web page which has been allotted with an individual user ID and password patterns, which enables the respective user to pay the bill from anywhere of the world. The created web page gives the complete details of bill payment, the consumed amount of data and a comparison with allow the user data. Hence this will allow the user to maintain an average and controlled usage of electricity.

The system mainly provides a automation function with an ON/OFF option for the electricity supply using the web page created, In addition to the above system we are implementing an partial automation system which enables the lighting, fan, AC etc on the basis of number of visitors or visitor counter. The most credible part of the on the e-auditing. Enterprise management system and change of the commercial analog environment surely results in the implementation process and innovation of new auditing environment in e-billing process.

1.1 GSM based e-billing and e-auditing

In the paper IoT Based Smart home design using security and power Management system introduces the implementation of the entire system with an Ethernet-based Smart Home design for monitoring the energy consumption based upon the real time measurement of the devices at home with the help of a 2nd generation Intel Galileo development board, widely used in homes as well as other buildings and societies [1]. The designed system mainly works on monitoring and control process over voice, so that the electrical devices can be automated using the common control system than the android app. It uses various sensors to not only monitor the real time device tracking but also maintaining the security of your house. It is monitored and controlled remotely from an android app using the Internet or the Intranet connectivity. The paper aims on the large benefits of recording electricity bills of the houses, offices etc as well as keep the users updated about their home security with an the automation process using their fingerprint or

touch on their Smartphone, and last but most importantly as the outcome, monitor the usage and conservation of natural resources by reducing energy consumption.

The paper directs the functionality of creating a Digitalized Environment for better and enlarged area of Energy Management at Homes. Here it has been clearly designed a reliable system of domestic energy management system (DEHEMS), which shows a beneficial electricity and gas monitoring in European-wide homes with less risk factors and a elaborate way. The paper defines the details of DEHEMS processed in triangular cyclic order for household's in order make a beneficiary report in the final Results based on both the measured tactical analysis data show that less energy has been consumed using this adaptive system[2].

Last Meter Smart Grid Embedded in IoT Platform which is a most robust advanced method in embedded system, it mainly shorten the data accessed, over Customer centric than distributor centric in transmission of power within the hosts. Here well designed approaches with a four basic principles are being followed which also deals with reliability and advantages with respect to the state of the art: 1) seamless integration for smart home applications 2) Collection of normless amount of data from heterogeneous sensor communication protocols attributed system 3) secure and customized data access from all over the assigned nodes 4) univocal sensor designed architecture and actuator mapping system to a individual or common abstraction layer on which extra applications can be constructed[3].

The introduction of Real Time AMR & Control of House Hold Energy Meter combined with Zigbee Communications, which is considered one of the recent evolving advanced technologies with the introduction of new Automatic and efficient Energy meter reading and overall control along with Zigbee communication [4]. The design mainly presents a configured arbitral method of combined Zigbee and GPS for Mobile communication (GSM) technology in order to monitor the consumed power consumption on daily or periodical basis and automatic control over meters remotely which enables the accurate management of electricity. This system is highly benifitable since it avoids the human intervention in the overall power usage. If the consumer doesn't pay the bill in time, the user is informed through SMS system using GSM module. If still user does not pay the bill then after the designed late consideration, the power connection will be disconnected from the remote server automatically.

Smart Home Management of energy has constructed a system that Includes Renewable Energy resources based on ZIGBEE prototype & PLD assembles HEMS architecture that considers simultaneously both energy and power consumption and supply for a smart home design. Zigbee based energy measurement modules are highly beneficial to monitor the energy consumption of home appliances and lights [5]. The data is generated on weekly basis based on the

energy consumption, analyzes them for energy estimation meter or other assigned devices, and home energy is well controlled using the scheduled strategy to minimize the electricity cost. The EMCUs are robust method of power management system to monitor the home appliances using the node control block.

The device table has the efficiency to manage both home appliances and lights connected to the EMCUs. On taking account of the Solar based intelligent energy distribution management system is a well-defined and reliable system with Intelligent power Energy Distribution Management (IEDM) to measure energy over the fast changing variable environment and solar power measurement process[6]. On Comparison with mutual interactive systems, they have introduced the IEDM for energy efficiency with a photovoltaic cell .

All environments has the capacity to measure the variable changes, hence renewable energy sources coincide with optimal energy management to obtain the highest efficiency and available growth.

Various researches over this topic have been analyzed for the appropriate designed Management products involving photovoltaic cell power and wind energy, and these IEDM is installed into a test bed system , its eventual results are verified which have significant roles in propagating friendly atmosphere in its performance and loss of energy. IEDM is preferably used to determine how solar panel can produce the efficiency that has to be used can be used. Hence IEDM creates a detailed data of the usage of solar batteries charge and power consumption.

IoT Based Data processing for Automated Industrial Meter Reading Using Raspberry pi presents the framework for an Internet of Things (IoT) device as an automated industrial meter reader that uploads the collected numeral data to cloud storage for centralized data processing [7]. The implementation of the device is done using Raspberry Pi as the platform. The device follows a four-step process- Image Acquisition using Raspberry Pi camera module, Optical Character Recognition using feature extraction technique, Internet Upload Mechanism using Google. The features of an effective data logging and analysis system are automation, high speed, low memory requirement and low computational complexity of the algorithm. This would require designing of measuring devices such as electronic meters that perform all these functions themselves Forms and Online Data Processing using Google Spreadsheet. The performance of the device and techniques for debugging are also discussed.

In paper [8] Research on Electronic Audit Model of quality assurance System for Network based was worked. The conception of electronic audit on quality management and assurance system was brought forward for the first time. Not only the design thought was analyzed and the total network and electronic structure was given, but also the visual networked auditing system of quality management

and assurance system was developed by applying WEB Service technology, module technology and audio-video network correspondence technology, which has solved the entire process of authentication and surveillance audit among different districts and industries by Internet and electronic-platform. Internal audit is also called first-audit, while external audit has two types that are second-audit and third-audit. Internal audit is that a organization audit itself, the audit objective is the organization's own quality system.

Second-audit is that the customer or nominal customer audits the suppliers or potential suppliers. Third-audit is to say that the authentication institutions audit the suppliers, whose objective is suppliers' assurance ability. Quality system is recognized by authentication, offered by Third-auditing system, is to assess and register suppliers' quality system, whose purpose is to prove the conformity and satisfaction requests that suppliers' quality system through assessing and supervising, so that can give independent approval to suppliers' quality management ability[9].

The architecture of the energy efficiency for the Internet of Things is a easy and assessable technology that has verticality to connect with anything at any time. Such tact able nature of IoT is responsible for energy source dripping. Therefore, the efficiency of energy at IoT has been into advanced research. In the paper, an energy-efficient design of architecture for IoT has been proposed; three layers are designed for its working, namely, control and sensing, sensing information, and presentation.

The architectural design allows the system to predict the sleep interval of sensors based upon their remaining battery level, their previous usage history, and quality of information required for a particular application.

The value is being predicted which is to increase the cloud resources utilization by provisioning the resources allocation when the similar sensory nodes are in sleep position. The utilization of this process in case of energy-efficiency in resources of IoT. The results experimentally show energy saving methodology over sensor nodes and improved utilization of improved sensor technology of cloud resources. The IoT is being used to maximize the communication of hardware objects with the physical environment and to convert the obtained data by these devices or objects into useful information without any human aid or intervention which is highly beneficial for saving time

2. IoT BASED E-BILLING AND E-AUDITING WITH ENERGY CONSERVATION

Automatic Meter Reading (AMR) has made a growth in the rapid technological advancements using e-metering system. This project presents the design of a GSM energy meter which is a wireless device and a low cost interlinked with web page for automatic billing and data collection globally. The traditional meter reading method is replaced

with remote existing energy meter by the energy provider and hence helps in remote accessing without the intervention of human effort. To have the overall access on the remote area, over the usage of electricity a GSM based wireless communication module is integrated with electronic energy meter for proper assessment. Database acts as the billing point which contains the PC attached with a GSM receiver at the other end.

Live meter reading from the GSM enabled energy meter is sent back to this billing point periodically and these details are updated in a central database. A new interactive, user friendly graphical user interface is developed using Microsoft visual studio .NET framework and C#(web page creation). With proper authentication, users can access the developed web page details from anywhere in the world. The complete monthly usage and due bill is messaged back to the customer after processing. Module is integrated with electronic energy meter for proper assessment. Database acts as the billing point which contains the PC attached with a GSM receiver at the other end. With proper authentication, users can access the developed web page details from anywhere in the world. The complete monthly usage and due bill is messaged back to the customer after processing.

2.1 GSM technology

A technology with high working proficiency and accuracy in European countries and all over the world is known as GSM, which is a mobile telephony system digitalized. In order to have wide access over the application and usage of electricity anywhere at any time, communication module is been introduced with the integrated electronic meter.

A PC with a GSM receiver at the other end, which contains the database acts as the billing point. Live meter reading from the GSM enabled energy meter is sent back to this billing point periodically and these details are updated in a central database.

2.2 Traditional Electro Mechanical Meters

Meters today used are highly prone to the climatic conditions as well as the temperature and time among them the most common is the traditional electro-mechanical meters that are widely used all over. As a result of the analytical and mechanical nature of the Components in these meters. Correct updating of meter reading is highly risky and not accurate since it requires human intervention to check the reading one by one over the installed meters. This method becomes much complicated when the reading has to be obtained from each places or houses especially in rural area, hence becomes costly.

The Meter readers are reluctant to make the effort to travel to such areas and will often submit inaccurate estimations of the amount of electricity consumed. For households at the top of high buildings and luxury housing plots, traditional meter reading is highly inefficient. There exists chance for

missing ills, absence of consumer etc. Even though these conventional meters were replaced with more efficient electronic energy meters these problems still persists. So a system which will provide the bill in users mobile will be more suitable in the current scenario.



Fig: Traditional Meter Read

2.3 E-billing and E-auditing using IOT

The power can be management by exactly knowing the limit of energy usage time to time, which can be done by the method of e-auditing or electronic auditing. The customer has a much beneficial facility to pay the bill from worldwide through the web page created in chance if the deadline of paying bill is over the electricity will be automatically turned off which has also lead to the monitoring of energy meters placed in different area especially in rural areas at lower cost is made possible widely. Daily consumption reports are generated which can be monitored through web portal avoiding man power. In order to save energy an automatic room electronic appliances controller (fan, Air Conditioner, lights etc.) are fixed so that on accordance with the number of visitors the electronic appliances can be assigned in a state of on or off condition on accordance with the number of visitors and hence displayed in the monitor board placed outside the room .

2.4 Advanced Metering Infrastructure

AMI stands for Advanced Metering Infrastructure which incorporates the overall systems that analyses the value collect and measures the accurate reading of electricity usage. An AMI system critically extends a level beyond AMR Technology by making a network path to the two way communication between the analyzer and the meter. Service barring system or disconnects are enabled for demand to the response actions or remote area services barring as well as disconnecting.

2.5 Smart Meter Reading

The data obtained by the MDMS are taken by the energy engine for further process, it then shows the rates analyzed, tariffs and new method is been introduced here which symbolizes a postpaid bills according to the users data based on the plan of the subscriber and makes the availability of the billed data to the customer, via electronic billing system through web portal and self-service web pages assigned .Anther important components in the meter-to-cash

operations. This is the method used for electronic billing, which reduces long queue and saves time.

2.6 Web Page Creation

The web page is created using the visual studio .To drag over and drop server, a controller is set to bring out the customers Web portal or designed page. For this purpose IDE which is defined as the Visual Studio Integrated Development Environment (IDE) is assigned.

Then we can eventually set the tools required for the customer’s satisfaction in billing and energy auditing purpose. These properties, methods, and events are used to define the web page's behavior, look and feel, and so on. To write server code to handle the logic for the page, you can use a .NET language like Visual Basic or C# (we page creation).



Fig: Web page model

2.6 E-billing Using IoT

A metering system which automatically senses the energy used ,creates the electronic bill and sends to the user web page using GSM technology which is existing already.

At last is collected and send to the customer accurately which is always accessible to the customer in their own web page. As it is web oriented once the data is updated, the registered users and authority can monitor and analyses the generated bill of any month by sitting anywhere in the world. This method is also effective in rural areas, which are not densely populated, and in which, most people do not have access to a fixed telephone network.

2.7 E-auditing using IOT

E-Auditing is recommended as a inspection along with survey and accurate analysis of energy usage, in an application for the conservation of energy in a building, process or system to reduce the over usage of energy within a bar limit so as to conserve energy for future use without negatively effecting the output. In the world of commercialized industries the energy audit is the key factor for analyzing and maintaining the expenses of energy usage. A home energy audit is a service where the energy efficiency of a house is evaluated by a person using professional equipment (such as blower doors and infrared cameras),

with the aim to suggest the best ways to improve energy efficiency in heating and cooling the house.

A home energy audit may include a written report estimating energy use given local climate criteria, thermostat settings, roof overhang, and solar orientation. This could show energy use for a given time period, say a year, and the impact of any suggested improvements per year. The accuracy of energy estimates are greatly improved when the homeowner's billing history is available showing the quantities of electricity, or other energy sources consumed over a one or two-year period.

Recently, the improvement of smartphone technology has enabled homeowners to perform relatively sophisticated energy audits of their own homes. This technique has been identified as a method to accelerate energy efficiency improvements. In this project the energy Audit plays an important role in the energy conservation of homes and other industries which enables us to protect the energy source without depletion and maintain the future needs as well.

3. CONCLUSION

In the digitalized, this paper is mainly concentrated on the connectivity & networking factor of the IoT, and energy consumption calculation based on the pulses calibrated is measured and is designed and implemented using PIC16F877A MCU in a domain of embedded system. In the proposed work using PLC as well as the IoT meter reading is done so that a system is designed in which the power source can be disconnected whenever the customer is reluctant to pay bill on time also it avoids human intervention, delivers effective meter reading, prevent the billing mistake, with monthly information updating of the power used and comparison values between the present and previous month. Enables energy saving by automatic on and off of the electronic appliances in a room depending on the number of visitors inside the room, indicated with display setting Overall the main advantage is the placement of IoT over GS

ACKNOWLEDGEMENT

The authors thank the management and principal of Dhanalakshmi Srinivasan College of Engineering, Coimbatore for providing an excellent computing facilities and encouragement.

REFERENCES

- [1] An IoT Based Smart home design using power and security Management was published by Jasmeet Chhabra and Punit Gupta (January 2016).
- [2] DEHEMS: Creating a Digital Environment for Large-Scale Energy Management at Homes Qi Liu, Member, IEEE, Grahame Cooper, Nigel Linge, Haifa Takruri and Richard Sowden (February 2013).
- [3] Last Meter Smart Grid Embedded in IoT Platform was established by Elisa spano, Luea Nicolai &Giuseppe Fannoccon (January 2015).
- [4] Real Time AMR & Control of House Hold Energy Meter with Zigbee Communication Dipti Yeolekar, H.H Kulkarni, and Dr.D.G Bhrathwaj (January 2015).
- [5] Smart Home Energy Management System Including Renewable Energy based in ZIGBEE & PLD was published and worked by Jinso Han , Chang-sic choi , Wan-ki-Park, Iiwor Cee ,Sang-Hakim (may 2014).
- [6] Solar based intelligent energy distribution management system was established by Insung Hong ,Byeong kwan kung & sehyung Park(May 2014).
- [7] Iot Based Data processing for Automated Industrial Meter Reading Using Raspberry pi was established by Prachi H. Kulkarni1, Pratik D. Kute1, V. N. More2(jan 2016)
- [8] Research on Electronic Audit Model of quality assurance System for Network based was worked and published by Xianlin REN Genbao ZHANG.

BIOGRAPHIES



DEVI SUBRAMANIAN

Received her bachelor of Electronics and Communication Engineering degree from Anna University, Chennai in 2016 and doing Master of Engineering in Applied Electronics from Anna University, Chennai. Her research interest includes IOT BASED E-BILLING AND E-AUDITING

Dr.N.SUMA

Received her bachelor of Electronics and Communication Engineering degree from Anna University, Chennai and MS from Anna university, Chennai. Lecturer in Sri Krishna College of Engineering, Associate professor in Karpagam Institute of Technology, Associate professor in SNS College of Engineering and currently working as HOD in Dhanalakshmi Srinivasan College of Engineering, Coimbatore