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Survey On Smart Energy Management System For ATM Using IOT

Haripriya H[1], Jaideep Joshua E[1], Geetha A[2]
[1]UG students, [2]Assistant Professor
Department of Computer Science and Engineering, Easwari Engineering College, Chennai--600089, India
Email: haripiya0596@gmail.com , joshuajaideep@gmail.com, geetha.vinodh1@gmail.com

Abstract
The shortage of resources in the present world is motivating many towards energy efficient technologies. Most notably, there is an increasing demand for electricity, hence it needs to be used optimally. To sustain the living of human beings electricity is the most important inventions. So, proper utilization of this resource is of immense importance to us. Though many technological innovations are taking place in this world, existing electricity consumption is soaring great heights. Also with the advent of digital banking in India the number of ATMs is increasing rapidly. In this paper we present a newly designed smart energy management meter for ATMs based on cheap distributed components like microcontroller architecture and sensors working on the concept of Internet of Things. This system aims at monitoring the energy consumption within ATMs using web application and mobile application and reduces the operational cost. It also monitors power tampering at ATMs by sending an alert message to the owner upon crossing the threshold.

Keywords: *Internet of things (IoT), Sensors, Smart energy meter, Microcontroller, GSM (Global system for Mobile Communication), GPRS (General Packet Radio Services)*

INTRODUCTION

Humans occupy the major part of the living system in the world, thus facing a major demand for all our basic needs. As we have started using many electrical appliances in our day to day lives, there is an exponential rise in the amount of energy consumed. Hence, if electrical energy is not properly monitored and controlled, then the demand for electricity will be greater than its supply, leading to power shortages. Hence the goal of this paper, is to monitor and reduce the electric power consumption, using a smart meter. Internet of things has helped many organizational systems to improve efficiency, increase the speed of processes, minimize error and prevent theft by coding and tracking the objects. Computing and communications has its future in the technological transformation brought by the IoT. Power consumption can be reduced to a great extent, if we can monitor our daily power usage and switch off appliances which are unnecessarily consuming electricity. This paper focuses on developing an energy management system that aims at reducing power consumption and also controls power tampering at ATMs using the concept of Internet of Things.

REVIEW OF LITERATURE

In paper [1], the authors De Capua C, Fulco G and R. Morello, proposed an outline of the potentialities of the sensing systems and IoT to monitor efficiently the energy flow among nodes of electric network. The proposed smart power meter intends to support the smart power grid to monitor electricity among different nodes in an efficient and effective way. Some challenges of this system include: the standardization of communication protocols, the improvement of the security standard, integration of the sensing

systems into existing systems, to assure interoperability, harmonisation of equipment standards to allow plug-and play and interface, new power flow routing algorithms and innovative routing criteria, management of big data coming from thousands of sensing systems distributed through the grid, redefinition of the metrics used for billing consumptions and modernisation of current electric network architecture.

In paper [2], the authors A.R. Al-Ali, M. Alikarar, R. Gupta, M. Rashid, I. A. Zualkernan, proposed an idea for implementing an Energy Management System (EMS) for smart homes. In this system, each home device is interfaced with a data acquisition module that is an IoT object with a unique IP address resulting in a large mesh wireless network of devices. The data acquisition System on Chip (SoC) module collects energy consumption data from each device of each smart home and transmits the data to a centralized server for further processing and analysis. This information from all residential areas accumulates in the utility's server as Big Data. The proposed EMS utilizes off-the-shelf Business Intelligence (BI) and Big Data analytics software packages to better manage energy consumption and to meet consumer demand. Some challenges of this system include: lifetime of a WSN network deteriorates with time due to the deployment of new sensors in the network, the data collected and aggregated solely by the home server in a system using zigbee as a communication protocol could lead to data loss in case of a system failure, the lack of standardized protocols and regulations were the main challenges in considering intelligent DC powered homes as suitable replacement to AC power systems and the device status and power consumption details transported to the web server through an extensible mark-up language (XML) interface would tend to be heavy weight for data delivery between browser and servers and the architecture will face significant bandwidth challenges in sending these large files across the network.

In paper [3] according to M. Albu, M. Sănduleac and C. Stănescu,a signal analysis framework for simplified PQ informative assessment method using the so-called instrumentation values available in most of today smart meters. Applications like smart grid synchro-SCADA observable and voltage control are also addressed in a novel design of Smart Meters, with negligible impact on cost. The main impediment in including calculation of PQ parameters among the functionalities of a SM appears to be their additional cost, mainly due to the fact that PQ is a well-regulated field, with detailed standards and norms in use, there have been only a few attempts to design low-cost PQ devices but these fail to comply with the minimal requirements imposed and developments in DSP components, like ARM Cortex with Digital Signal Processing (DSP), allowing complex computations for energy measurement with low uncertainties.

In paper [4] D. Gualda, Á. Hernández, José M. Alcalá, J. Ureña, present a novel method for homecare monitoring systems based on the use of a sensor. The proposed event detector simplifies parameterization to increase its scalability while keeping similar performance. The classifier outperforms them due to its unique load signature (the PQD power trajectories) and the PCA reconstruction error method that successfully models and classifies general appliances. This study extends preliminary results in by including comparative results with other previous methods. However, physiological signals measured by direct monitoring methods often involve blood oxygen saturation, heart rate and breathing which are very accurate but non-scalable,

since sensors need to be attached to the body.

In paper [5] R. Jia, M. Jin, and C. J. Spanos, design a system which uses occupancy detection for residential and commercial buildings to improve energy efficiency, user comfort, and space utility. The pervasiveness of electricity meters eliminates the additional system cost and setup/maintenance efforts. Hence, electricity meters are viable candidates for presence sensing, with the added benefits of safeguarding privacy information (compared to cameras), and improving reliability (compared to environmental measurements). The capability of power for presence detection is first demonstrated in BL with methods like SVM and random forest. As a result, accuracy rates are 74 to 89% for residential buildings and about 90% for offices. TL approach tackles the case when data from other sources are used in the current learning task. Its results further confirm the appropriateness of using power to detect occupancy by producing superior performance as compared to standard SVM. Additionally, it will be promising to perform sensor fusion with other mobile nodes, such as smart phones, fitness trackers, and automobiles, for further improvement.

In paper [6] the authors Indrajit Banerjee and Nashreen Nesa, proposed that detection of occupancy in a room from various ambient sources like temperature, humidity, light and CO2. In this system, remote monitoring of the building as well as leveraging control on the indoor parameters through HVAC control systems is possible at real-time. It also adopts Dempster-Shafer Evidence Theory for fusing sensory information collected from heterogeneous sensors, assigns probability mass assignments to the raw sensor readings, and finally performs mass combination to derive a conclusion about the occupancy status in a room. A probability mass assignment function has been proposed for this purpose. The results reveal a substantially high percentage of accuracy (up to 99.09%). estimate the number of occupants as well. household or office rooms in order to detect occupancy at real time. The model has to be first trained with some training samples after which it can run smoothly for any number of test cases. However, in case of change in location the model has to re-train to adapt to its changed environment which is a prerequisite for any classification model.

In paper [7] P. Latha, J. Roselin and A. H. Sanoob, proposed a new design for surveillance using smart phone along with the passive infrared (PIR) sensor and the microcontroller unit (MCU). The PIR sensor is attached to the smart phone through the MCU to detect motion. The video is captured only when the motion is detected and the short message services alert is sent to the user straight away. To overcome the memory restrictions of smart phone and to ensure the safe storage of surveillance records, it is uploaded in cloud, and the link is sent to the user through email. The proposed intelligent surveillance system offers cost effective, storage effective, energy efficient, and secured solution as it uses the computation and communication capabilities of the smart phone and the storage capabilities of cloud. The efficiency of our design can be further improved by adding more sensors to it. In-order to increase the quality of the video during nights, the lights may be turned on automatically when intrusion is detected. The digital image processing algorithm may be implemented in the application module of smart phone to differentiate radiation changes between human and animal species.

In paper [8] Qing Yang, Shenglong Dong and Suohang Duan proposed an innovative mechanism to compensate the errors caused by different types of natural gases

on the sensor's reading. The proposed solution first measures the physical property of metered gas to derive the composition correction coefficient that will then be used to correct the meter's reading errors, considering the relation between the calorific value and physical property of natural gases. In this way, the proposed solution realizes a real-time multi composition gas metering via thermal gas flow sensors. It detects the composition of metered natural gases, in real time, with an accuracy of 1.5 grade.

In paper [9] Lutz Lampe, Vincent W.S. Wongand Yanan Sun designed a load hiding approach that obscures household consumption with the help of energy storage units. For this purpose, they combined the use of electric vehicles and heating, ventilating, and air conditioning systems to reduce or eliminate the reliance on local rechargeable batteries for load hiding. It was found that the joint use of EV and HVAC achieves a better privacy protection at about the same energy consumption cost but with a battery of only one quarter the capacity of the battery-only case.

In paper [10] George Mois, Silviu Folea and Teodora Sanislav, presented three different IoT-based wireless sensors for environmental and ambient monitoring such as one employing User Datagram Protocol (UDP)-based Wi-Fi communication, one communicating through Wi-Fi and Hypertext Transfer Protocol (HTTP), and a third one using Bluetooth Smart. Their analysis presents a starting point for the selection of a direction in the implementation of IoT-based environmental monitoring applications, providing an overview of the potential and challenges of each one of the three developed wireless sensors.

Tabulation

S.NO	Paper	Technique	Result	Issues
1	A Smart Power Meter to Monitor Energy Flow in Smart Grids	Sensing systems and IoT	Monitor efficiently the energy flow among nodes of electric network	Standardization of communication protocols, improvement of the security standard, integration of the sensing systems into existing systems, to assure interoperability.
2	A smart home energy management system using IOT and big data analytics approach	IoT, Big Data Analytics, Business Intelligence and Wireless sensor network	Implementing an Energy Management System (EMS) for smart homes.	Data loss in case of a system failure, the lack of standardized protocols and regulations and significant bandwidth challenges while sending large files over the network.
3	Syncretic Use of Smart Meters for Power Quality Monitoring in Emerging Networks	PQ informative assessment method	Power Quality (PQ) monitoring and control, based on a lightweight assessment of voltage parameters implemented in smart energy meter.	Calculation of PQ parameters among the functionalities of a SM appears to be of additional cost, complex computations for energy measurement with low uncertainties.
4	Sustainable Homecare Monitoring System by Sensing Electricity Data	WSN, PQD power trajectories, PCA reconstruction error method and DST and GMM models	A novel method for homecare monitoring systems based on the use of a sensor.	Physiological signals measured by direct monitoring methods are very accurate but non-scalable, since sensors need to be attached to the body and recognize ADLs in order to evaluate the accuracy.

5	Virtual Occupancy Sensing: Using Smart Meters to Indicate Your Presence	Methods like SVM and random forest and TL approach.	Providing occupancy detection for residential and commercial buildings alike to improve energy efficiency, user comfort, and space utility.	Requires performing sensor fusion with other mobile nodes, such as smart phones, fitness trackers, and automobiles, for further improvement.
6	Sensor Data Fusion for Occupancy Sensing using Dempster-Shafer Evidence Theory for Smart Buildings:	Dempster-Shafer evidence theory and probability mass assignment function	Detection of occupancy in a room	In case of change in location the model has to re-trained
7	Smartphone Enabled Intelligent Surveillance System	Passive infrared (PIR) sensor and microcontroller unit (MCU)	Detects the presence of a person	Low quality of the video during nights
8	MEMS-Based Smart Gas Metering for Internet of Things	Micro Electro & Mechanical System	Eradicates the errors caused by different types of natural gases on the sensor's reading	Manual thorough investigation of the physical properties of natural gases is required.
9	Smart Meter Privacy: Exploiting the Potential of Household Energy Storage Units	Smart metering, Markov decision process and Q-learning	Achieves better privacy protection at about the same energy consumption cost	Limited predictability of household demand.
10	Analysis of Three IoT-Based Wireless Sensors for Environmental Monitoring	Bluetooth, low-power electronics	Provides three different IoT-based environmental monitoring applications.	Reduced transmission reliability

Conclusion and Future Work

From the review of various journals, it is concluded that, the usage of advanced technology improvises energy management and automation. However, there has not been a drastic change in the behaviour of these systems but many new ideas have been proposed. Before implementing any such technology a thorough knowledge about every component used has to be studied and analysed. As future work, we would like to implement this system on a large number of ATMs.

REFERENCES

1. De Capua C, Fulco G, R.Morello (2017), **"A Smart Power Meter to Monitor Energy Flow in Smart Grids"**, *IEEE Sensors Journal*, Volume - 17, Issue -23, Pages: 7828 – 7837, 2017.
2. A.R. Al-Ali, M. Alikarar, R. Gupta, M. Rashid, I. A. Zualkernan, **"A smart home energy management system using IOT and big data analytics approach"**, *IEEE Transactions on Consumer Electronics*, Volume - 63, No - 4, pp. 426-434, November 2017.

3. M. Albu, M. Sănduleac, C. Stănescu, **"Syncretic Use of Smart Meters for Power Quality Monitoring in Emerging Networks",** *IEEE Transactions on Smart Grid*, Volume - 8, No - 1, pp. 485-492, January 2017.
4. D. Gualda, Á. Hernández, José M. Alcalá, J. Ureña, **"Sustainable Homecare Monitoring System by Sensing Electricity Data",** *IEEE Sensors Journal*, Volume - 17, No - 23, pp. 7741-7749, December 2017.
5. R. Jia, M. Jin and C. J. Spanos, **"Virtual Occupancy Sensing: Using Smart Meters to Indicate Your Presence",** *IEEE Transactions on Mobile Computing*, Volume - 16, No - 11, pp. 3264-3277, November 2017.
6. I. Banerjee and N. Nesa, **"IoT-Based Sensor Data Fusion for Occupancy Sensing Using Dempster–Shafer Evidence Theory for Smart Buildings",** *IEEE Internet of Things Journal*, Volume – 4, No - 5, pp. 1563-1570, Oct. 2017.
7. P. Latha, A. H. Sanoob, and J. Roselin, **"Smartphone Enabled Intelligent Surveillance System",** *IEEE Sensors Journal*, Volume - 16, No - . 5, pp. 1361-1367, March1, 2016.
8. S. Dong, S. Duan, G. Li , R. Tao Q. Yang, and J. Zhang, **"MEMS-Based Smart Gas Metering for Internet of Things,"** *IEEE Internet of Things Journal*, Volume - 4, No - 5, pp. 1296-1303, Oct. 2017.
9. L. Lampe, Y. Sun and V. W. S. Wong, **"Smart Meter Privacy: Exploiting the Potential of Household Energy Storage Units",** *IEEE Internet of Things Journal*, vol. 5, no. 1, pp. 69-78, Feb. 2018.
10. S. Folea, T. Sanislav and G. Mois, **"Analysis of Three IoT-Based Wireless Sensors for Environmental Monitoring,"** *IEEE Transactions on Instrumentation and Measurement*, vol. 66, no. 8, pp. 2056-2064, Aug. 2017.