Impact Factor (SJIF): 5.301

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444

Volume 5, Issue 4, April-2018

A Smart Meter Design and Implementation Using GPRS Based Wireless Sensor Network in Smart Grid

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ABSTRACT

The Wireless Sensor Home Area Network (WSHAN) with GPRS interfaced smart meter is designed and implemented, Because of the increasing demands on electricity, traditional electric grid needs to be replaced with intelligent, robust, reliable and costly effective smart grid applications. Wireless Sensor Networks (WSN) has a critical role to set up reliable and costly effective smart electric power grid applications. Our system measures energy usage, logs data real-time and shows time of use (TOU) values. The system also controls any device connected to power outputs. While powering on and off, zero-cross of AC signal is detected to calculate phase shift. The smart meter provides correct power usage and transmits data with GPRS to PC (Personal Computer). The user monitors the power information and remotely controls the system. The current sensor is used to identify the amount of energy usage level and covert the data into digital where it is transmitted to the EB server database with the help of GPRS module. EB person will also login and get the readings of every person instead of going to their home.

RELATED WORK

Sentiment analysis is a long standing research topic. Readers can refer to [25] for a recent survey. Sentiment classification is one of the key tasks in sentiment analysis and can be categorized as document level, sentence level and aspect level [25]. Traditional machine learning methods for sentiment classification can generally be applied to the three levels[25]. Our work falls into the last category since we consider aspect information. In the next we review two subtopics closely related to our work.

LITERATURE SURVEY

S.NO	TITLE	AUTHOR	ABSTRACT	YEAR	ADVANTAGE	DISADVANTAGE
1	Radio frequency interconnection between smart grid	Salma Oudji Stains Courreger Christian Brauers Philippe magneron	The main idea is to continuously monitor the whole system energy and optimize it in order to increase the overall energy efficiency. It is used to control the current incase of high consumption equipment at a period of peak demand of electricity.	2015	Ease of access and low cost power consumption. Alert system is quick in case of emergency. Smarter processing and services	Security concerns. High dependency on radio frequency make system fail when distance ranges
2	Application of wireless sensor network in smart grid	Pawan pandey Poshpendra mishra Ruchita.ghune	Manual collection of data is very difficult and timesaving consuming task.Therfore a wireless mechanism is used, the task is achieved by wireless sensor network. WSN can enhance in various electric power system.	2013	Cost effective and dynamic self organization. Balancing load on the network Good network coverage range	Mesh networking lead to network capacity and fading This lead to sufficient amount of smart node
3	Demand Side load scheduling incentivized dynamic energy prices	Hadi goudarzi Safar hatami Massoud pedran	Electricity consumes are encouraged to consume electricitymore prudently in order to minimize their electric based on dynamic energy prices. This paper help consumer to minimize their energy cost by setting the time of use of	2011	Reduce their consumption at critical times in response to higher energy prices. Cost reduces	Shifting peaks and increasing emissions Cost is higher(devices)

			energy in the facility			
4	An efficient merkle-tree based authenticatio n scheme for smart grid	Hongwei Li Rongxing Lu Liang Zhow Xuemin Shen	Smart grid faces some critical such as security challenges such as message injection attack and replay attack. In this paper we propose an efficient authentication scheme to secure smart grid communuication.	2013	Security and privacy strength Resilience to replay attack	Takes times to receive a message between sender and receiver.
5	Aggregated Load scheduling for Residential Multi-Class Appliances: Peak Demand Reduction	Armin Ghasem Azar Rune Hylsberg Jacobsen Qi Zhang	Demand Response programs provide mechanisms to regulate the power demand through load control according to conditions of the supply side,where consumers canefficiently	2014	Optimally schedule the smart appliances in each time interval by decreasing the peak to average ratio	High peak of energy emissions
6	Efficient Authentication Scheme for Data aggregation in Smart Grid with Fault Tolerance and Fault Diagnosis	Depeng Li Zeyar Aung, John R. Williams Abel Sanchez	In this paper, we present an efficient and robust approach to authenticate data aggregation in smart grid via deploying signature aggregation, batch verification and signature amortization schemes to less communication overhead, reduce numbers of signing and verification operations, and provide fault tolerance.	2015	fault diagnosis algorithms are presented to detect failure points and minimize the fault execution times	Resilient to denial of service(dos) attack
7	Improved Appliance	Firas A. Al Balas	The goal of this work is to introduce an efficient	2016	reduce the total energy	High peak of energy

	Coordination Scheme with Waiting Time in Smart Grids	Wail Mardini Yaser Khamayseh	scheme to reduce the total cost of energy bills by utilizing the ACORD-FI scheme obtain energy		consumption of home appliances	emissions
8	Effective Machine to Machine Communications in Smart Grid Networks	Deepak Puthal Bibhudatta Sahoo B .P. S Sahoo	The smart grid purpose is to create near-real-time control mechanisms that improve the quality of electricity delivery, reduce carbon emissions, manage distributed energy resources, provide automated demand response and reduce the cost of electricity to consumers	2012	Pervasive computing regime, and can be adopted in many applications (e.g., public safety, energy management, and transportation) with objectives to improve efficiency and reduce cost.	Communication delay, cost effective, real time monitoring and security.
9	Residential Task Scheduling Under Dynamic Pricing Using the Multiple Knapsack Method	Kumaragurupar an N., Sivaramakrishn an H., Sachin S. Sapatnekar	This paper presents a solution to the problem of optimally scheduling a set of residential appliances under day-ahead variable peak pricing in order to minimize the customer's energy bill (and also, simultaneously spread out energy usage)	2012	residential energy scheduling under a dynamic pricing paradigm	In this connection, for finer-grained scheduling, fractional time slots with contiguous scheduling may be desirable.
10	Enhancement of Communication Technologies and Networks for Smart Grid Applications	SaidaElyengui RiadhBouhou, Tahar zzedine[3]	In this paper we will give an overview of smart grid reference modelandacomprehensiv e survey of the available networks for the smart grid and wireless communication technologies for smart	2013	Explored related networks and communication technologies that could be adopted for thesmart grid communication infrastructure on smart distribution	Mesh Topology leads to some problem in routing that has to be taken care

			grid ommunication		and domains	
11	Opportunities and Challenges of Wireless SensorNetworks in Smart Grid	Vehbi C. Gungor, Gerhard P. Hancke	The collaborative and low-cost nature of wireless sensor networks (WSNs) brings the significant advantages over traditional communication technologies used in today's electric power systems.	2010	Statistical characterization of the wireless channel in different electric-power-system environments has been presented.	The Values Provide here will continuously keep on changing,that makes it hard to predict the output.
12	Wireless Sensor Networks for Cost-Efficient Residential Energy Management in the Smart Grid	MelikeErol-Kantarci, Hussein T. Mouftah.	Wireless sensor networks (WSNs) will play a key role in the extension of the smart grid towards residential premises, ,enable various demand and energy management applications.	2011	We introduce the OREM and the iHEM schemes to reduce the share of the appliances in the energy bills and to reduce their contribution to the peak load.	we are planning to include learning techniques from the artificial intelligence (AI) field to increase consumer comfortpervasiveness of our application.
13	Smart control for Smart Grids: from lighting systems to Grid Side Management	Huerta-Medina N, Corominas E.L., Pablo J. Quintana, M.Rico Secades	System integrates street lighting, renewable energy sources, energy storage devices and inverter connected to the mains.	2016	capable of reducing the energy consumption of the lighting system or injecting energy back to the mains if needed.	The energy demand curve of the grid could be smoothed when enough of this LSG were deployed.
14	Non-Intrusive Power Measurement Method with Phase Detection for Low-Cost Smart Meters	Haoyuan Yang and Shu-Yuen Ron Hui	This paper describes a non-intrusive power measurement method that is suitable for a new type of low-cost and easy-to-install smart meters	2017	Measuring current and power from parallel electric cables based on non-contact magnetic flux and identifying the power consumption of each phase.	This method is only suitable for a new form of smart meter applications that require very easy and non-intrusive installation

CONCLUSION

In this paper Wireless Sensor Home Area Network (WSHAN) with ZigBee interfaced smart meter was designed, implemented and tested. Our system measures energy usage, logs data real time and controls any device connected to power outputs. The power usage was measured by the smart meter prototype and the calculated data was transmitted through ZigBee communication to PC (Personal Computer). With the PC software, scheduling with TOU pricing showed that it creates an economic expenditure for consumer and it's all the same for the utility side. Our contribution is a smart meter system with consumer control in energy saving events corresponding to smart grid concept.

FUTURE WORK

For future work, we plan to investigate how to combine different methods to generate better prediction performance. We will also try to apply WDE on other problems involving weak labels

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