

IoT Based Prepaid Energy Meter

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Abstract: The billing process of electricity consumption currently used is very long process and requires lot of man power. The energy billing in India is error prone. Going to each and every consumer's house and generating the bill is a laborious task and requires lot of time. Errors get introduced at every stage of energy billing like errors with electro-mechanical meters, human errors while noting down the meter reading and error while processing the paid bills and the due bills. There are many cases where the bill is paid and then is shown as a due amount in the next bill. There is no proper way to know the consumer's maximum demand, usage details, losses in the lines and power theft. If any consumer did not pay the bill, the operator needs to go to their houses to disconnect the power supply. These processes are repetitive and take so much time. For overcoming all the difficulties present in the system a fully automated billing system is proposed i.e. "Prepaid Power Billing Using Adaptive Meter". In the proposed system, electronic energy meter is replaced by Adaptive meter which includes both metering of the power consumed and prepaid system. The billing process is prepaid energy billing in which customer has to pay first and then use it. This system also implements an automated system which can charge different amounts for power consumption during different times. The prepaid system uses method of GSM based recharging. The recharging can be done from any remote place without accessing the energy meter physically.

Keywords: Energy Meters, Internet of Things, ESP8266, Microcontroller

I. INTRODUCTION:

The trend of the time has always been in favor of that technology which finally become cost effective as well as an elegant one. Indian power sector is facing serious problem of lean revenue collection as against energy supplied due to energy thefts and network losses. All the steps taken so far, regarding the improvement of the revenue collection did not yield satisfactory results. It is reported that the faultiest sub system in the metering and meter reading system. Traditional meter reading is done by the human operator, this require a more number of labor operator and long working hour to achieve the complete area data reading and billing. Due to increase in the development of residential building and commercial building the meter reading task increases which require more number of human operators. In order to achieve efficient meter reading, reduce billing error and operation cost, automatic meter reading system play an important role^[1].

In postpaid system, there is no control use of electricity from the consumer's side. There is a lot of wastage of power in the consumer's side due to lack of planning of electrical consumption in an efficient way. The idea of designing the Prepaid Power Billing using "Energy Meter" is due to the basis that it would indirectly help to create a better understanding and awareness towards the value and the importance of electrical energy, energy saving, promoting of smart energy management as well as an innovation towards further improvement to proven existing system^[1]. The Adaptive meter is not only limited to automate the meter reading but also attributed with prepaid recharging ability and information of consumed data can be exchange between the grid and consumer. It was also due to the fact that in time to come, the cost of electrical energy generation continuously increase and the energy consumption may exceed its productions or generations. By realizing such idea, end users are provided with the proposed system to assist them in carefully planning and managing their electrical consumption. This is also helpful in saving the time of both electricity authority and consumer.

II. LITERATURE SURVEY:

Meter Reading and Billing are among the most time consuming functions performed by municipalities and energy distribution companies. These functions have a major influence on the utilities cost, efficiency, productivity, structure and cash flow as well. Solutions based on recording readings manually, then entering it into a central billing system are time consuming, prone to errors and delays in delivering bills to customers with negative effect on cash flow. There are many methods involved in the meter reading process; this includes traditional manual methods up to fully automatic meter reading systems:

Traditional system: Traditional meter reading is done by the human operator, this require a more number of labor operator and long working hour to achieve the complete area data reading and billing. Due to the increase in the development of residential building and commercial building the meter reading task increases which require more number of human operators. It should be clear that such methods are very time consuming and does not satisfy the business requirements for the power company, in addition to the large number of errors incorporated in the reading process. This type of systems cannot provide transparency.

Pic based energy meter: To improve the efficiency of the billing system this method was invented. This is an electronic energy meter designed to replace conventional electromechanical meters in which PIC based is more accurate than conventional energy meters. In this system the energy consumed by the user is measured, and according to that the charges were applied. The main aim of this system was to safeguard the electrical system from over voltage, under voltage and over load conditions. Over voltage and under voltage conditions are detected by using a step down transformer and full wave rectifier. Over current condition

was detected by using a current transformer which is connected in series with the load. But this system is not so much effective in prepaid billing process as this did not reduce the laborious tasks and this is only useful in protective purpose.

An automatic meter-reading system based on GSM. To obtain meter reading when desired so meter readers don't need to visit each customer for the consumed energy data collection and to distribute the bill slips. Microcontroller used to monitor and record the meter readings. In that case a customer defaulter, no need to send a person to cut-off the customer connection. The utility can cut off and reconnect the customer connection by short notification and the customer can be able to check the status of electricity (load) from anywhere. In energy meter readings are being transferred by making use of GSM [2]

The current energy billing systems are discrete, inaccurate, and costly and time consuming. The major drawback of traditional billing system is power and energy theft from customers. The above drawback is reduced by using a prepaid energy meter system which is based on the concept of "Pay first and then use it" [3]

III. EXISTING SYSTEM:

In existing system an energy meter is installed at every house which records energy consumed by user. Then a person hired by MSEB goes to each and every house and collects the data which he gives to MSEB. Then MSEB calculates the bill. According to that data bill is send to user by post to user.

If a user doesn't pay the bill, then after a lot of time period MSEB sends workers to cut off that particular power supply. When that person pays the bill then MSEB sends a man to connect the power supply. This system has some major drawbacks such as going to remote areas is not easy. The person sends MSEB may or may not know the area. While going to remote area a lot of time is wasted. That person may not take reading from all users. There are possibilities of error in taking the reading. Then he comes back to submit data to MSEB. Then MSEB is able to calculate the result. In this process a lot of time is wasted. in this system a lot of labor work is needed. MSEB have to pay these people extra money to do work. If MSEB have to cut power supply, then a person goes manually cut supply. At first a power supply is disconnected and again have to reconnect a person has to go that place and connect.

IV. PROPOSED SYSTEM:

In this prepaid energy meter, the grid power is used to supply electricity to the prepayment meter. When there is no connection between power grid and meter in such condition DG set is used for electricity supply to the prepayment meter. The prepayment meter is interlinked with the billing server. Billing server is used for send and access specified data. The billing server is depending on web portal. In prepaid energy billing server customer has to pay first and then use it. In web portal the user can check the amount their remaining balance and also recharge option is provided.

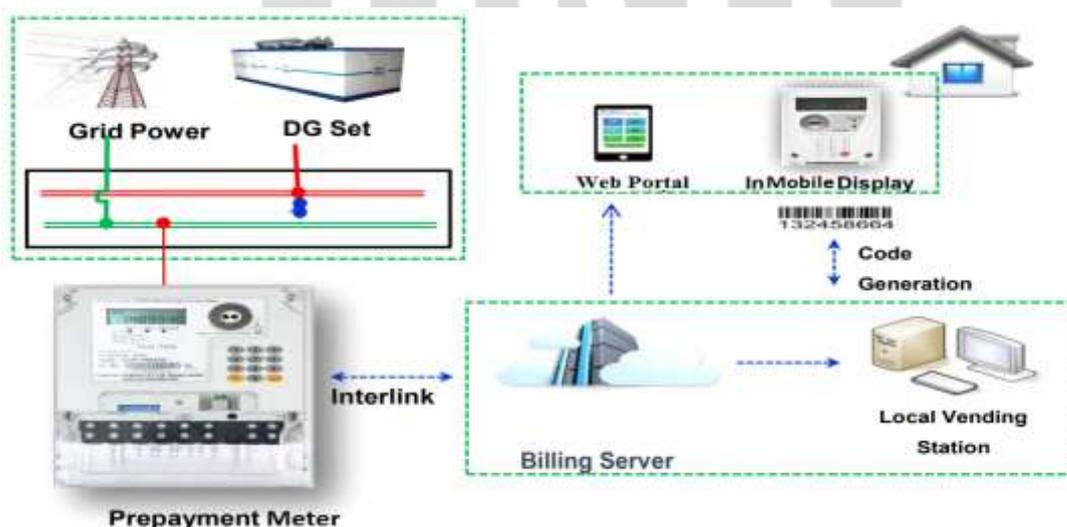


Fig 1. Proposed System Architecture

Development Tools:

Developer Tools	Description
JDK 1.8	For JAVA Platform
Xampp /workbench	For My Sql database
Eclips/Net beans	For android code editing
Apache Tomcat 7.0.56	For database servlets
Latex	For report generation

Testing Environment

Software Required (Client Browser)	Description
OS	Windows , Linux
Browsers	Chrome , Mozilla Firefox etc.
MODEM Drivers	For internet connections

V. CONCLUSION:

The proposed GSM based energy meter is easy to install and beneficial for both energy Provider and Customer. This reduces revenue cost and reduces the human errors and problems like over running of the meter etc. This leads to reduction of outstanding dues. This device improves usage level and energy monitoring. The proposed system continuously monitors the meter reading and shut down the power supply remotely whenever the recharged units become zero. It avoids the human intervention, provides efficient meter reading, avoid the billing error and reduce the maintenance cost.

REFERENCES:

- [1] Nazmat Toyin, Olufenka timilehin David “Development of Internet Based Prepaid Energy Meter” IEEE African 2017 Proceedings, pp.1370-1373, 2017.
- [2] Satish P., Raghul A, Srinvas B, Sajaudeen N, “Automated Meter Reading System: A Study”. Intr J. of Comp Applications, vol. 18, pp. 39-45, 2015.
- [3] Sapna ganurkar, pravesh gour, “Prepaid Energy Meter for billing system using microcontroller and recharge card”. International journal of core engineering and management volume1, issue 1, April 2014
- [4] Mohassel, R. R, Alan S. F, Farah M, and Kaamran R "A survey on advanced metering infrastructure and its application in Smart Grids." IEEE 27th Canadian Conf. on Elect and Comp Engineering, pp. 1-8, 2014
- [5] Omijeh, B. O. and Ighalo, G. I. “Modelling of GSM-Based Energy Recharge Scheme for Prepaid Meter”. Journal of Electrical and Electronics Engineering vol.4, pp. 46-52, 2013.
- [6] Md. Ashiquzzaman, Nadia Afroze, Taufiq Md. Abdullah “Design and Implementation of Wireless Digital Energy Meter using Microcontroller” Global Journal of Researches in Engineering Electrical and Electronics Engineering Volume 12 Issue Version 1.0 February 2012.
- [7] Young Hoon Lim, Moon Suk Chain, Jong Mock Baek, Sang-Yeom Lee “An an Efficient Home Energy Management System Based on Automatic Meter Reading” in IEEE International Symposium on Power Line Communication, 2011.
- [8] Jubi. K, Mareena J, “Prepaid Energy Meter with GSM Technology”. American International Journal of Research in Science, Technology, Engineering & Mathematics, vol.1, pp. 195-198, 2010.