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AUTOMATIC EB BILLING AND DISCONNECTION SCHEMES USING IOT

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ABSTRACT

In this system an automatic meter reading system is designed using IOT Technology. The embedded micro controller is interfaced with the ESP8266 Module. This setup reads energy consumption data based on which the consumption data is calculated. This controller calculates the data and transfers that data to IOT Module. The IOT will provide the remote communication of the EB reading data to the remote EB server. The system or the EB sever generates the customer bill in every two months once as per government norms based on power usage of the customer. Then the used unit rate values are verified by EB official. According to the readings, the billing information also can be viewed by the authorized customer. If the bill due exceeds a particular period and customer doesn't pay bill on-time, the power supply to the corresponding home can be disconnected by the authority by accessing the control provided on the server. Once the payment of bill is done the power supply is given to the customer through IOT server page. And also the system includes energy auditing with Power management concept is introduced, in which during the restriction mode only limited amount of power supply can be used by the customer.

Keywords: IOT, Web Server, ESP8266, Energy audio and power management etc.,

I. INTRODUCTION

Electrical power has become indispensable to human survival and progress. Apart from efforts to meet growing demand, automation in the energy distribution is also necessary to enhance people's life standard. Traditional meter reading by human operator is inefficient to meet the future residential development needs. So there is increased demand for Automatic Meter Reading (AMR) systems which collects meter readings electronically, and its application is expanding over industrial, commercial and utility environment. Electronic utility meters are an important step towards automating the utility metering process. Automated utility meters have

many new features that help to reduce the cost of utilities to customers and the cost of delivering utilities to the utility provider. The onset of rural electrification provides opportunities for new and more efficient metering technologies to be implemented. Traditional electro-mechanical meters, still widely used today, are prone to drift over temperature and time.

This method of collecting of meter readings becomes more problematic and costly when readings have to be collected from vast, and often scattered rural areas. 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 bills, 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. Here a new method of post paid electronic energy metering is introduced in this paper which will automatically sense the used energy, records these reading continuously, then sends it to the billing point through the existing IOT network. Finally after processing the collected data bill is generated using a web based system software and is send back to the customer as WEB data. 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.

And also the system includes energy auditing with Power management concept is introduced, in which during the restriction mode only limited amount of power supply can be used by the customer.

B. Existing system

Tariff recommendation is an important marketing means for retailers in electricity market. Based on the power consumption data acquired by the advanced metering infrastructure, tariff recommendation can not only match customers with appropriate tariff but also guide customers to adjust power consumption strategy. In this paper, an adjustment oriented electricity tariff recommendation method based on typical customers is proposed. Fuzzy clustering algorithm is applied to power consumption data of appliances to extract the consumption feature of each kind of appliance. Then the decision tree is constructed, which correlate the class features of appliances with clusters of customers. Pre-pruning decision tree is deployed together with use of depth-first search to exclude meaningless nodes of the decision tree, so that the typical customer set is determined. The tariff recommendation model is constructed aiming at minimum electricity bill, which credits to optimize benchmark strategy of power consumption for typical customers. The model is solved by particle swarm optimization. Simulations show

that the proposed method enables customers to understand the adjustment signal revealed by the tariff, and results in electricity bill reduction due to participating in demand response as retailers expected.

Problem Identifications

- Tariff adjustments measures are handled for energy management and billing.
- Remote Power management control is not provided.
- Optimization of billing is done in order to provide electricity bill reduction

Objectives

The main objective of the system is to measure the periodic EB meter readings as well as load disconnection process from customer areas such as home, industry etc., by using wireless application protocol (WAP).

C. Proposed system

In this system an automatic meter reading system is designed using IOT Technology. The embedded micro controller is interfaced with the ESP8266 Module. This setup reads energy consumption data based on which the consumption data is calculated. This controller calculates the data and transfers that data to IOT Module. The IOT will provide the remote communication of the EB reading data to the remote EB server. The system or the EB sever generates the customer bill in every two months once as per government norms based on power usage of the customer. Then the used unit rate values are verified by EB official. According to the readings, the billing information also can be viewed by the authorized customer. If the bill due exceeds a particular period and customer doesn't pay bill on-time, the power supply to the corresponding home can be disconnected by the authority by accessing the control provided on the server. Once the payment of bill is done the power supply is given to the customer through IOT server page. Power management concept is introduced, in which during the restriction mode only limited amount of power supply can be used by the customer.

II. LITERATURE SURVEY

Lilavati Pujari [1] In recent scenario, energy saving holds prime significance because of inequality between demand and power generation. Using Wi-Fi module entire system will be controlled. Internet of Thing (IoT) is internally related to computing tricks transferring the data

under the network with no any help of a human to human or human to computer interrelation. The load to the consumer is to consume regularly with regular monthly payment of the bill. When the electricity bill is paid then the supply will continuously flow or provides. Energy conservation is the important needs in these days. Increasing the demand for energy consumption there energy monitoring will be taking important role hence it is considering as the research focusing on both electricity consumer and provider. This paper provides the ability to get the electricity bill, electricity providing days, and the previous bill also. Using the Internet of Things technology the transferring data is very easy to see for both the providers and consumers and even easy to make payment of electricity bill and to keep the continuation process and discontinuous process easily.

Dr. S.S. Sayyed [2] In this paper, we study and discuss various automated systems for electricity energy meter. These systems provide automation and eliminate human involvement for meter reading process, theft detection and disconnection of electricity transmission. These automated systems provide accuracy in billing and also enables the consumers to do power optimization by providing electricity consumption information on frequent basis. This consumption information can be provided to the user either through Webpage, Android application or through SMS. This paper focuses on various techniques that can be used for providing security to electricity meter from electricity theft attempts. Theses automated systems also introduce automatic disconnection of the electricity in the case of any tampering happens or in case where consumer fail to pay the electricity bill on time. This paper also discusses various challenges of existing system and how the automated systems can overcome from them. Keywords: Internet of Things (IoT), Electricity Board (EB), Global System for Mobile communications (IOT), General Packet Radio Services (GPRS), Radio Frequency (RF).

D. SajedulIslam [3]Electricity, the most usable form of energy is used widely through the whole world. With the evolution of modern technology, the usage of electricity is escalating gradually. But the production of electricity is confined due to deficiency of resources. So power must be used in a concise way. In many countries, electrical energy is measured by energy meter which is inspected by a human. According to their inspection, the electric bills are prepared and most often these are prepared on the basis of assumption which could be inaccurate, costly, time-consuming as well as error prone. Due to the absence of regular monitoring system, sometimes consumer use electrical energy month after month without paying any bill. Energy meter

monitoring and digital billing system is a kind of system which would be able to avoid traditional meter reading, save human resources, improve the accuracy and prevent the power theft. In this paper, a remote monitoring of energy meter and digital billing system is inaugurated through

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IOT 900. For monitoring server, major programming languages had been introduced to relate the methodologies, execute logical functions, store data in a database and send the monthly bill to the consumer cell phone number and finally disconnect the unpaid consumer.

III.SYSTEM OPERATION

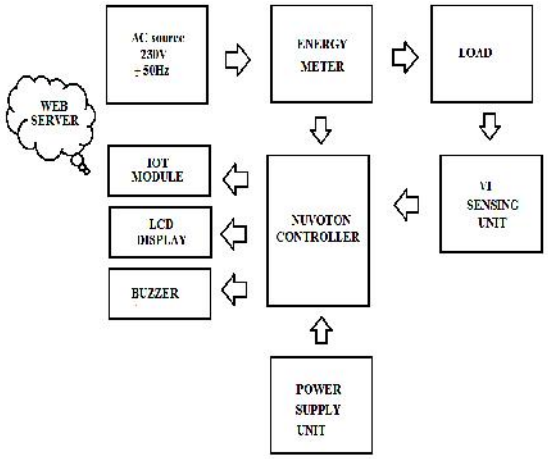

Fig.1 Functional block diagram of the system

The system architecture of microcontroller based automatic EB billing process with theft identifier system is shown in figure 3.4. The system consists of Digital Energy Meter, Nuvoton Microcontroller, Voltage and Current sensing unit, buzzer, Relay and Liquid Crystal Display (LCD). Energy Meter IC generally produces electrical pulses proportional to the power consumed by the consumer and the power supply of microcontroller. Microcontroller calculates the energy consumed by the consumer utilizing the output of Energy Meter and programs loaded on the microcontroller. Voltage and Current sensing unit feeds the actual current and voltage of load connected to consumer side to the energy meter. IOT (module) interfaced with the microcontroller unit which is used to communicate the information about the measured bill to EB server as well as customer and also it shows the bill status and due date through web data. Relay mainly performs the switching operation which is used to turn ON and turn OFF the power connection between energy meter and load through supply mains depending upon the bill payment. The buzzer unit is used to alert the customer on due date and it continuously alert if

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customer not paid the bill. The buzzer is automatically turned OFF when the customer paid the bill.

Liquid Crystal Display shows the energy consumption, number of unit revitalized by the consumer, rest of the unit and maximum demand. The energy billing system is shown in figure 1.

Energy audit

The energy can be audited by the controller based on the formula which predicted from algorithm. The server unit sets number of units in the web data according to the consumer's demand. The calculated energy data's are send to the server by using ESP8266 Wi-Fi MODEM. The calculated energy data is stored in cloud server for energy management. The energy meter is used to measure the utilized power of the AC loads for reference. The +5V DC power supply unit is used for controller and MODEM operation.

Data Acquisition for Calculating Power

The Energy Meter IC AD7751 produces an output frequency that is proportional to the time average value of the product of two voltage signals. The input voltage signals are applied across pin 4, 6 and pin 8, 7 of Energy Meter IC. The Energy Meter IC also provides an output frequency at pin 22 of Energy meter IC equal to the output power that can be calculated using an equation as

$$F = \frac{5.74 \times V_1 \times V_2 \times Gain \times F_{1-4}}{V_{REF}^2} \quad (1)$$

Where

V_{REF} – Nominal reference voltage

$F_{1-4} = 1.7$

V_1 = Voltage applied across load current

V_2 = Voltage applied across line to neutral voltage

This output frequency is proportional to real power information. During calibration we have got the frequency F=0.5 Hz against 1.5 KW load. When F=0.5Hz, then power = 1500Watt. So for any value of the frequency at F, Power P. P will be

$$P = \frac{1500 \times X}{0.5} \quad (2)$$

$$P = 3000 \times X \quad (3)$$

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Energy calculation

The complete equation for determining the energy or units consumed from power, P is obtained as follows

$$1\,\text{WattSec} = \frac{1\,\text{kWSec}}{1000}$$

$$1\,\text{WattSec} = \frac{1\,\text{kWh}}{1000 \times 3600} \qquad (4)$$

$$\text{Energy} = \frac{P \times \text{Sec}}{1000 \times 3600}\ \text{Units}$$

$$\text{Energy} = \frac{3000 \times X \times \text{Sec}}{3600000}\ \text{Units} \qquad (5)$$

IV. EXPERIMENTAL RESULTS:

Table : Energy consumption and audit

	Load			Power
	40W/ hr	60W/ hr	100W/ hr	Cumulative Power (C_p)
Day1	12	5	1	880
Day2	4	6	4	920
Day3	3	8	7	1300
Day4	7	7	9	1600
Day5	6	1	2	500
Day6	9	3	4	940
Day7	8	2	6	1040
			Total (Tp)	7180
			avg per day	1025.714286
			avg per hr	42.73809524
			per month	30771.42857
			per year	369257.1429

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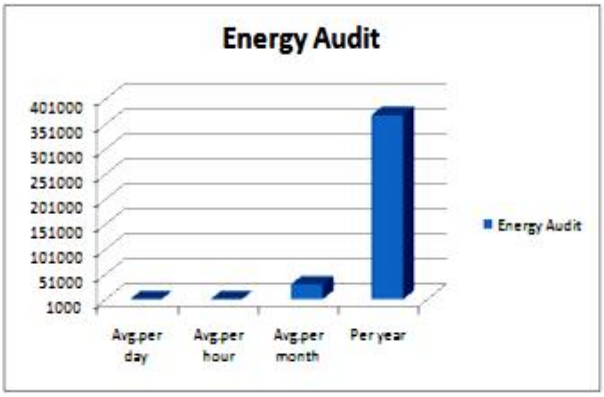

Fig.2 Comparison chart for energy audit

Primary Formula for energy audit

$$\text{Total}\frac{\text{Power}}{\text{Day}}(Pi) = \sum_{i=1}^{n} \text{Li} * \text{Ti}$$

- Average power Pa $=\sum_{i=1}^{n} \text{Pi}$ / n
- Average power per day (Pd) = Average Power (Pa) / 7
- Average Power per hour (Ph) = Pd/24

CONCLUSION

The system is successfully completed to measure and control the consumer EB billing system with theft detection by using wireless communication protocol. The embedded micro controller is interfaced with the IOT Module. This setup is fitted in home. The energy meter is attached to the micro controller. This controller reads the data from the meter output and transfers that data to IOT Module through the serial port. The embedded micro controller has the knowledge of sending message to the web server through the IOT module. The data is monitored in EB office, which is the authority office. The system generates the customer bill in every two months once as per government norms based on power usage of the customer. Then the used unit rate values are sent to the EB office PC through IOT module. According to the readings, the authority officer will send the information about the bill to the customer. If the customer doesn't pay bill on-time, the power supply to the corresponding home power unit is cut, by sending the command through to the microcontroller. Once the payment of bill is done the power supply is

given to the customer. Power management concept is introduced; disconnect the supply for unpaid consumer.

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