Effective Power Consumption Monitoring of Smart meter through IoT

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Abstract. Now a day’s electricity consumption in residential homes day by day is increasing. For verification and keep monitoring is very critical task because we have to go physically to take the meter readings in meter existing room. Well it is essential for a consumer because according to the electricity consumed the amount will be charged. We can automate the framework or system by checking the energy meter readings over the web. Our proposed system utilizes microcontroller with energy meter to track the electricity power consumed. With using of GSM module we can transmit the consumed units along with amount charged to the web portal so that consumer can monitor the data over the web. This allows the consumers can check the cost charged and power consumed units online by utilizing a simple web application. Therefore the consumers can monitor the energy meter readings very easily along with the cost and also consumers can check the bill amount online itself:FOTA(Firmware Over-The-Air) option is also available with this option one can update the firmware remotely. FOTA is required if any bugs are available in existing software so to remove the bugs we are updating the firmware remotely. The need of FOTA to remove the bugs in existing software so that we can remotely access particular device and update the version easily.

Keywords: Internet of things, Smart electric meter reading, Microcontroller, Hypertext Markup Language, Global System for Mobile Communications, Firmware Over-The Air.

1. Introduction
The main intension of this paper is to provide a real time accessibility of the power consumtion and power bill. A web portal through which we will access the energy meter remotely by using a meter identification number and each energy meter identification number must be identical so that the research and development team can easily access the meter. The front-end software is used for real time power consumption remotely and through this one can analyze the things in smart meter[1]. Smart meters are installed in several residential houses and domestic sectors also[2].To reduce bill distributors and also we can eliminate fraud by electricity power consumers. The advantages of smart energy meter are there is no need of human operator to go to the consumers address to take down the reading. Hence extra labor cost is reduced, the consumers or clients will be traced out of their electricity power utilization, theft of electricity can be avoided by tamper proof energy meters, and the readings recorded can be used by the Research and development department and IoT interfaces countless devices that gather metadata for handling[4].

2. Literature Survey
The basic working idea is to get the appropriate reading from the energy meter accurately and also the idea of an SMS service by a GSM module [3]. Smart energy meter is a solution to overcome this problem. In smart energy meters we make use of an GSM module through which the energy consumption is up-loaded to the web page through which we can have a clear view of our power consumption.Today exchanges of news, opinions and data is very important and this can be achieved through the internet so smart meters are linked to in-ternet to upload the data into web portal [5-6].
In [7] the authors designed “AAMR approach for energy saving in Smart Grids” and they described about restriction of energy management and increasing utilization electricity power. The main intention of this article for recognizes a continuous evaluating because of the proposed communication system. One of the solution for smart grid is smart meters [8].

In [8] the authors designed “ARM-based energy management system using smart meter and Web server”, in which they described a low cost ARM-based energy management system and also explained about power system parameters which are utilized for the cost to be charged according to the consumed energy units. Developed front end application for gathering the electricity power from each energy meters which are deployed in remote areas. Controlling the home appliances is very important in our daily life and this can be handled by using emerging technology called IoT [9-10].

3. Proposed System
Here we are designing the software and that software must be deployed in the mobile or personal computer and also we are using one server which is maintained by admin department in which we are storing the electricity usage and based on the usage the amount can be determined and it is stored in database [11]. The energy meters for collecting billing data from remote areas and it will send to the central server and consistently the client or consumers can get to the everyday data required about the quantity of power utilized and also consumers find out the amount for utilized power from the server in daily basis. In this way, the consumers will get an alarm about the electricity usage and seek to decrease the power consumption so due to this the consumer can save the amount. The main purpose of smart meter is to check the electricity usage or consumption and expose the overall electricity power consumption. The readings of KWH units and along with smart meter identification number that information will be send the central server in regular interval or on hourly basis. Server is utilized for to accumulate the information from each and every residential homes and every HT consumers for future examination and investigation purpose and also we can access the web portal by personal computer or in mobile.

4. Methodology
The general procedure of the paper is appeared in the accompanying fig. 1 refered as architectural design of smart meter.

The equipment and the software interface are associated with one another to examine the electricity utilization of the clients or consumers and further, this will be examined by central server and thereby the smart meter also send the Instantaneous data, Billing, Load-survey, power failure events and current date and time to the central server for analysis purpose by research and development team and consumers by accessing the web portal in computer or mobile. The smart meter can expose some parameters such as current, voltage and power on 16X2 LCD display. The microcontroller sends the meter data such as date time and KWH parameters on to LCD. The functional diagram of the proposed system is shown in fig. 2.

Functional diagram is nothing but a flowchart to understand the operation step by step in a simple manner. The functional diagram represents the total operation of the framework or system. So we can extract step by step operation with the help of functional diagram. This flow chart will be stepwise, concurrent or branched. We are using variety of elements in functional diagram like join, fork, etc.
Figure 1. Architectural Design of Smart Meter

Figure 2. Functional Diagram
5. Implementation

We required both hardware and software to accomplish the system and for designing the web-portal, the things we required as XAMPP, MICRO KEIL VERSION 4, EMBEDDED C Programming, HTML, JavaScript and PHP Language. For hardware side, we required the devices like current sensor, voltage sensor, GSM Module, liquid crystal display (LCD), ARM7 Microcontroller and Computer or Mobile. Current Sensing anyway presents substantially more troublesome issues because of the rich consonant substance in the current waveform. Current transducer sensor not just requires an a lot more extensive estimation dynamic range, yet in addition important to manage of an a lot wider frequency range. The below fig. 3 represents hardware connections.

![Figure 3. Hardware Connections](image)

An area delay power-efficient CLA adder is presented in this paper. By using the CLA generator we can reduce logic operations. In this way, the gate count for carry look-ahead adder can be significantly minimized from 32 to 28. However, the proposed CLA design involves less area, delay, and power dissipation than the recently proposed CSLA [1]. Due to the small output carry delay, this adder is best suitable for the arithmetic unit. The synthesis results reveal that the proposed adder provides approximately 10% ADP than existing adder designs of 8-bit widths.

Voltage Sensing is generally calculated from the methods called a step-down voltage transformer or voltage division method. Based on the design or work requirement the best method can be chosen. From the ARM-7 family we are taken the ARM7 MICROCONTROLLER LPC2148 for developing the firmware to read the data from the smart meter and it is having core software or programs which are dumped into the micro-controller for interfacing peripherals easily. The microcontroller which is used to develop the high-end projects.

GSM module is interfaced with micro-controller and the GSM module having the internet via a WLAN. A front-end application is specially developed for storing the data from different energy meters which are deployed in residential homes and from HT consumers in remote areas. The consumers can access the smart meter with using of smart meter identification number (Meter ID) to monitor the consumed electricity energy with the help of front-end application and we can also monitor the KWH units in LCD display.

6. Conclusion

By using ‘IoT Based Smart Energy Meter’, we are making the system in more real time model and using this model one can effectively measure the electric-ity power consumption in residential homes and it is very easy for taking the energy units like KWH values from the energy meter remotely. Thus, it de-reases the unwanted usage of electricity power and cause knowingness for all of them and it will
also reduce the human intervention and one more ad-vantage with Smart Metering system is we can easily update the firmware or application in microcontroller through the option called FOTA (Firmware Over-The-Air). Through the FOTA option we can remotely update the firmware easily. FOTA is required if any bugs are available in existing software so to remove the bugs we are updating the firmware remotely.

By changing this system home intelligence will demonstrate developing ad-va-vantages to IoT field. To get the efficient power-supply and power saving in smart grid by utilization of emerging technology called IoT. IoT technology is very useful where smart actions are required such as smart devices and auto-mation system to make the cities into smarter.

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