IOT BASED SMART ENERGY MONITORING SYSTEM

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Abstract: ***The smart grid is the integration of electrical and information infrastructures. Here to improve the power communication between generation, transmission, distribution and consumer we required advanced information technology based smart energy monitoring system (SEMS). Hence the advanced information technology need fast and reliable communication protocol i.e. Zigbee, Internet of Things (IoT) and Cloud Computing. These are the communication devices which are used to develop the smart energy monitoring system (SEMS). In future using SEMS easily we can obtain the closed loop communication for developing smart grid. This paper presents the comparison among these three types of SEMS and also get the final solution in which communication protocol suitable for implementation of closed loop communication. The concept of smart grid is combination of smart energy monitoring system, smart energy management system and smart energy control system. In this aspect smart energy monitoring system is the important tool which is interface with the energy management system and energy control system respectively. Hence the SEMS provide the electrical information in real time to energy management system without any delay time; we can obtain the efficient energy management system.***

Keywords: Smart Energy Monitoring System (SEMS), Zigbee, Internet of Things (IoT), Cloud computing.

I. INTRODUCTION

Electricity is the heart of the nation, to save the national environmental we should save energy. Hence to save energy, our energy system will get smart. Where as to implement the smart energy system we required power transmission, power distribution and power utilization in smart manner [1].

Here power communication is one of the major tool for making all the process as closed loop. In the proposed system, IoT based smart energy monitoring system has been developed in real time.

IoT protocol: The internet of things is a network of ever growing physical objects (such as connected devices and smart devices), embedded with electronics, software, sensors and network connectivity that enables these objects to collect and exchange data. The Internet of Things (IoT) objects features an IP address for internet connectivity, and the communication that occurs between these objects and other Internet-enabled devices and systems. [2-4].

II. SMART ENERGY MONITORING SYSTEM USING IOT PROTOCOL

A. System Overview

Here the SMES using IoT Techniques is designed to continuously monitor the electrical parameters from the digital meter and to cut the power supply through wireless techniques, if any short circuit or over load utilization [5].

Data can be collected at each and every second's basis. As there is no human intervention in the entire process, there is no chance of human error and corruption. In the extremely bad weather conditions like heavy snow, rain, storm, etc the system will not hamper on collecting [6]-[8]. Fig.6 shows the difference between conventional energy meter and smart meter system.

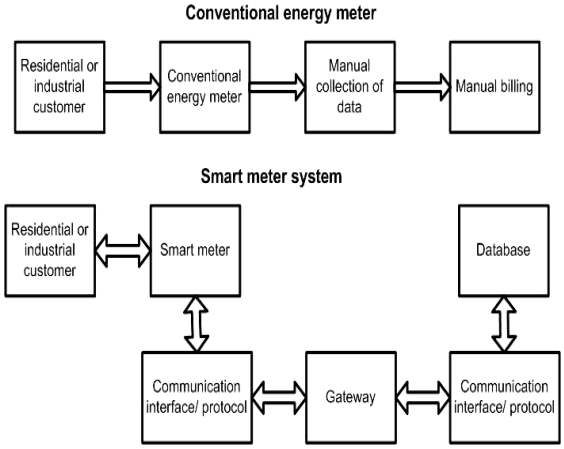

Fig.1. Comparison of Conventional and Smart Meter System

Advantages:

- Automation has been evaluated. So, the chance of human error and corruption will be reduced.
- In the extremely bad weather conditions like heavy snow, rain, storm, etc the system will not hamper on collecting.
- Illegal Social activity avoided (Power Theft).

B. System Implementation

IoT based SEMS functional diagram shown in Fig.1. The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical system, which also encompasses technologies such as smart grids, virtual power plants, smart homes and smart cities. Each thing is uniquely identified through its embedded computing system but is able to interoperate within the existing internet infrastructure [9].

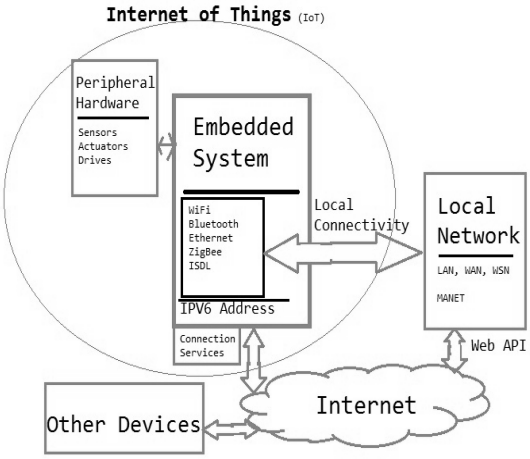

Fig.2. IOT interfacing Hardware

When the various appliances of the household consume energy the energy meter reads the reading continuously and this consumed load can be seen on meter. We can see that the LED on meter continuously blinks which counts the meter reading. Based on the blinking, the units are counted. Normally, 3200 blinks is one unit. In our project we are trying to develop, a system in which Arduino Uno act as main controller, which continuously monitor energy meter.

As per the blinking of LED on energy meter the Arduino will measure the unit consumption. The measured reading with the calculation of the cost will be continuously displayed on web page that we have designed. Threshold value can be set on webpage with the help of Wi-Fi, as per the consumer's requirement. When the consumers reading will be near about to the set threshold value it will send a notification value to the consumer [10].

This threshold value notification will increase the awareness amongst the consumer about the energy. When the consumer gets the notification he can visit the webpage and change the threshold value. If the consumer is not aware with the threshold notification, then the meter will automatically get off. Then the consumer has to visit the webpage again and increment the threshold value. By the incrimination, the meter will automatically get ON.

Finally the overall monthly bill with cost will be sent to customer as well as service provider in the form of text at first day of every month.[11]-[14]

C. Software Used and Output Result

The Arduino Integrated Development Environment or Arduino Software (IDE) - includes a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them. The hardware of the SEMS by IoT shown in the Fig.8 and measured parameter displayed in the system in Html File shown in Fig.4. [15]

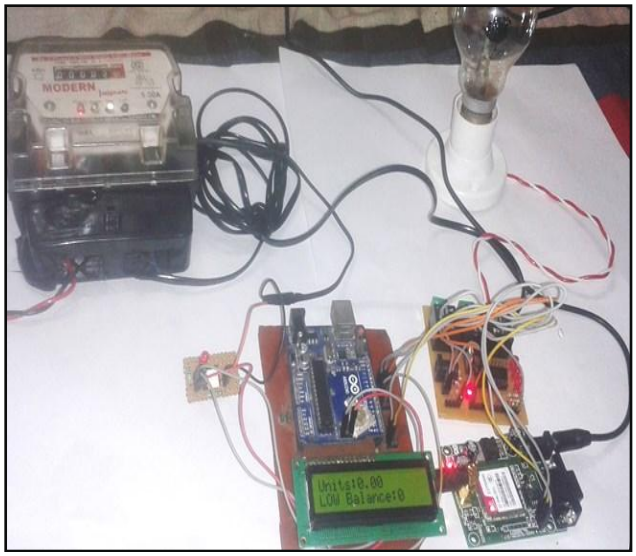

Fig. 3. Monitoring Hardware Interface

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE) shown in Fig.9, including complete error messages and other information. The bottom right-hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor [16].

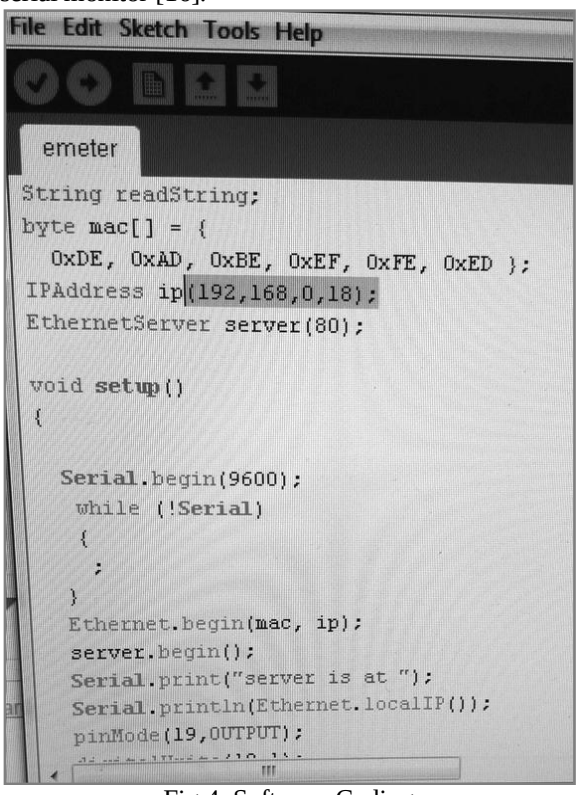

Fig.4. Software Coding

Fig.5. Output Screen

III. CONCLUSION

We propose in this paper an advanced technology that can monitor the electrical information without any interval on the Internet In addition, an embedded system-based communication gateway that can be interfaced with our local cloud and set up easily made with domestic and commercial users. Moreover, the exact power consumption information are stored in a database server in the Cloud. Hence the stored information will be send as a report to the energy management system. And the control command from the far-end place, i.e., from the web server on the Internet, is first sent to the gateway and then transmitted to the IPS modules through the wireless communication protocol so that the remote control access can be achieved. With help of this concept, we actively reduce standby power consumption and the power outlet simultaneously through the communication gateway. Also the consumer can now about the power utilization before the monthly assessment.

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