Smart Energy Meter

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Abstract- *Hourly electric smart meter data combined with daily gas smart meter data provide the information necessary to perform an intelligent disaggregation of residential energy use. Proprietary, cloud-based analysis software from High Energy Audits (HEA) automatically separates a year's worth of energy use into seven categories and presents this information to homeowners through a 15-minute interactive online audit. This level of analysis provides sufficient information for homeowners to independently make effective, low-cost changes resulting in reduced electric use in 66% of the homes participating. This method was utilized in five San Francisco Bay Area towns commencing in April 2011 and ending in April 2012 with over 200 households registering to participate in the free program throughout the year. A total savings of 105,293 kWh was observed when compared to energy consumption in the previous year, or an average of 634 kWh per home across all participants completing the audit.*

I. INTRODUCTION

Energy meters in India have dominantly been electromechanical in nature but are gradually being replaced by more sophisticated and accurate digital and electronic meters. A high percentage of electricity revenue is lost to power theft, incorrect meter reading and billing, and reluctance of consumers towards paying electricity bills on time. Considerable amount of revenue losses can be reduced by using prepaid energy meters. The smart meters known today are simply automated reading units, or ARU, capable of computing the power consumption and cost for the consumption in accordance to the time of the day, and day of the week. On other hand, the advanced metering infrastructure, or AMI, is a system of utility meters that measure the consumption and provide the information to the utility companies, as well as the consumers interested in keeping the usage costs low, or wanting to supply the electricity back to the grid [1]. As for the energy efficiency issues of smart metering devices, since most smart metering devices adopted wireless communications such as Zig-Bee and Wireless Sensor Network (WSN) based on IEEE802.15.4[2]. Smart meters are being introduced in many power systems world-wide to provide real time power consumption and price information to consumers. Smart Meters are electronic measurement devices used by utilities to communicate information for billing customers and operating their electric systems. The combination of the electronic meters with two-way communications technology for information, monitor, and control is commonly referred to as Advanced Metering infrastructure (AMI). Previous systems, which utilized one-way communications to collect meter data, were referred to as AMR (Automated Meter Reading) Systems. AMI has developed over time, from its roots as a metering reading substitute (AMR) to today's two- way communication and data system. This paper proposes the use of smart meters in distributed generation which is still more advanced than the existing methods providing efficient transmission and evacuation of power.

II. METHODOLOGY

The proposed block diagram as shown in fig 1. Communicating Power Supply (CPS) concept measures the energy use of the device it is powering, reports the energy use and device's identity over a network to a central entity, and receives control information from users or other devices via the same central entity. At the same time, the user is still able to control power state directly using interfaces on the product, so that the existing, native controls are retained [7]. Measure energy consumption of each device and store this data to cloud based web service. The web service collect this information and if user want to control power state then receive network based control information from user and pass this control request to the CPS device. According to that control the power state of that device. The device should be connected to power line to control it. Energy data uploaded to internet immediately after measurement. This data is monitored in real time and control the individual device at the same time.

In analog measurement circuity current is measured by current sensing circuit. By knowing current and voltage value we can calculate power. This analog value is converted to digital by using A-to-D converter and this value is sent to raspberry pi. Ethernet is interfaced with raspberry pi to store a data on cloud, where data is uploaded and archived by using a cloud-based data storage and web hosting. The user can monitor this stored data in real time and control the device.

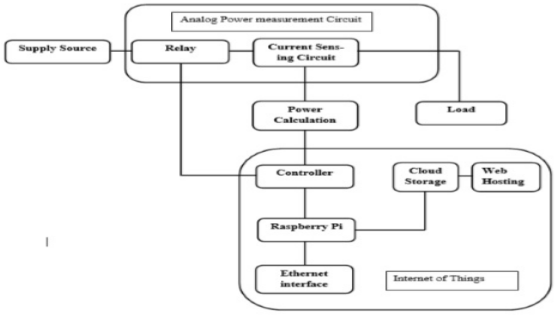


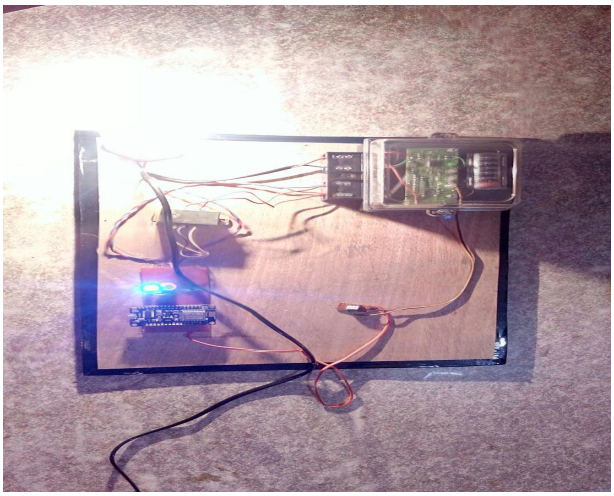
Fig.1 Proposed Diagram

B. Communication protocol In wired communication i.e. power line communication during data transmission signal interference occur in network. This causes signal attenuation and distortion which implies very low security. The complexity and re-wiring cost of wired communication is more than wireless technology. So there is various short-distance wireless technology are available. It has flexible networking pattern. So it is very convenient to use in resident. The various wireless technologies are Bluetooth, ZigBee and Z–Wave. These technology operates in the Industrial Scientific and Medical Bands (ISM Bands), and the frequency range is 2.4GHz. Low cost, low power consumption, low speed these are various features of wireless technologies.
By leveraging the flexible SoC features and the communication protocols available to the designers, manufacturers have a wide design space to effectively address the range of metering options: from low-cost solutions to top meters which offer wider memory, higher configurability, reliable network protocol and higher accuracy of the measure.
The ability to code and track objects has allowed companies to become more efficient, speed up processes, reduce error, prevent theft, and incorporate complex and flexible organizational systems through Internet of Things (IoT). The IoT is a technological revolution that represents the future of computing and communications, and its development depends on dynamic technical innovation in a number of important fields, from wireless sensors to nanotechnology. They are going tag the each object for identifying, automating, monitoring and controlling.

Device-level metering method measures energy use of each device. The data is collected through these studies have significantly improved the knowledge of plug loads energy use in U. S. building [2]. These are software and hardware infrastructure that facilitate communication between the enduse monitor and the central entity. The embedded systems are programmed to gather data from the energy monitor and communicate this information over the network layer to the data server. A user dashboard would be located on a mobile device or PC, which allows control and monitoring via the data server [7].

Steven Lanzisera [7], "Communicating Power Supplies: Bringing the Internet to the Ubiquitous Energy Gateways of Electronic Devices", introduced the concept of the communicating power supply (CPS) that adds electricity metering, computation, and communication to electronic devices. It presented an Internet-connected system of CPSs that enables improved energy awareness of devices and users. CPS technology is the future of energy monitoring for plug loads, and that all energy-using devices will one day be aware of their identity and share energy information over IP networks.

S. Lanzisera, H. Y. I. Cheung [8], introduced "Methods for detailed energy data collection of miscellaneous and electronic loads in a commercial office building. This paper, explain how to quantify different aspects of the metering, such as number of devices to inventory and meter, how long to collect meter data, sampling rate and so on. The study was designed to look at the methodology for collecting accurate energy information on annual energy use, usage patterns, and energy savings opportunities of representative plug loads in a typical office building.



III. CONCLUSION

Energy meters in India have dominantly been electromechanical in nature but are gradually being replaced by more sophisticated and accurate digital and electronic meters. A high percentage of electricity revenue is lost to power theft, incorrect meter reading and billing, and reluctance of consumers towards paying electricity bills on time. In this paper brief introduction about smart grid and smart meter are given and also the advance metering infrastructure discussed. Here various wireless communication

used in smart meter technology is described and also the comparison of four different technology is given. Here we conclude that PLC method has high initial cost and Zig-bee method has low cost, long battery life and more secure so Zig-bee method is more preferable for smart metering communication application.

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