AUTOMATIC BILL GENERATING ENERGY METER

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Abstract: Rapid technological advancements have happened in the technology of e-metering (Electronic Metering) and the demand for reliable and efficient Automatic Meter Reading (AMR) system has been increased. Some simple, low-cost wireless energy meter for automating billing and managing the collected data globally has been discussed here. The proposed system discussed here replaces traditional meter reading methods used and enables remote access to the existing energy meter by the energy provider. Also, the energy provider can monitor the meter readings regularly without the person visiting each house by sending the information of the energy consumed to the user via SMS, and also send a confirmation SMS Base station. Billing information of multiple ('n') users is communicated using single GSM which can also be used by Base Station for revision of charges also controlled by Base Station.

Index Terms - GSM, Energy Meter, Microcontroller, Load

I. INTRODUCTION

In India, electromechanical energy meters are dominant and it been replaced by more sophisticated and accurate electronic and digital meters. Presently energy metering and billing use the electromechanical and digital meters .It takes more time and labor and the main reason is the tradition billing system which is incorrect. Many times slow, costly and lack of flexibility as well as reliability. Today, in electrical billing accuracy is very important .Using Wireless Energy Meter monitoring and analysis of data is made easy and also meter has a capability to send data via wireless communication to PC or any remote devices. Victoria expected to complete smart meters by electricity distributors by the end of 2013 so that it will shift retailers to charge based on the actual consumer cost and also to allow retailers to monitor consumer load profiles. Electricity consumption timing shows dramatic differences of power consumption in retailer profitability between peaky and flat load consumers. High and low-cost consumers are identified using these meters. The end user component of power includes distribution, generation, transmission, and retail. Now the responsibility for purchasing electricity in wholesale market and billing customers is in hands of retailers. Traditional meters (domestic purpose), are read once in a month and the consumers are charged irrespective of timing period of their energy consumption. Retail pricing is time-invariant, though wholesale costs vary widely over time, this leads to and the mismatch between retail price and wholesale cost. Today's smart meters are simply automated reading units, which has a capability to monitor i.e. calculating power consumption and cost, for the time of the day and day of the week. on the other side, advanced metering infrastructure measures the consumption and provides the information to the utility companies, also to the consumers for keeping the usage cost low [1]. 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].

Advanced Metering Infrastructure (AMI) is two-way communications technology for information, monitor, and control is commonly a combination of the electronic meters. Existing systems, one-way communications to collect meter data, were referred to as AMR (Automated Meter Reading) Systems. The smart meters are used to generate advance system than the previous methods providing transmission and the shifting of the power [3]. This aims to systematically review the development of smart energy meters, which consists of the following specific objectives:

1) to review the present development and deployment of smart energy meters;
2) to analyze the main functions and applications of smart energy meters;
3) to discuss the possibility and requirements for interoperation of various energy networks.

II .TYPES OF ELECTRICITY METERS

The most common type of electricity meters is the electromechanical meter. The measurement of electricity flow is done by counting the revolutions of electric metal, it has a speed which rotates proportional to the power through meter [5]. Although electromechanical meters do not contain any comprehensive function, they have been adopted by the electricity industry for a long time due to their reliability in most cases. With incremental requirements on the control o supply and demand, electronic meters, which are integrated with many advanced functions, started to replace electromechanical meters.

Modularization is an important way to design smart meters in practice and the metering component is usually sealed in a complete module, which can be later connected with other modules [6], [7]. Making a smart meter an open structure and adding more functions by connecting it with other modules can largely facilitate the innovation and deployment of smart meters. In addition, it is easier for modularized Systems to achieve interoperation.

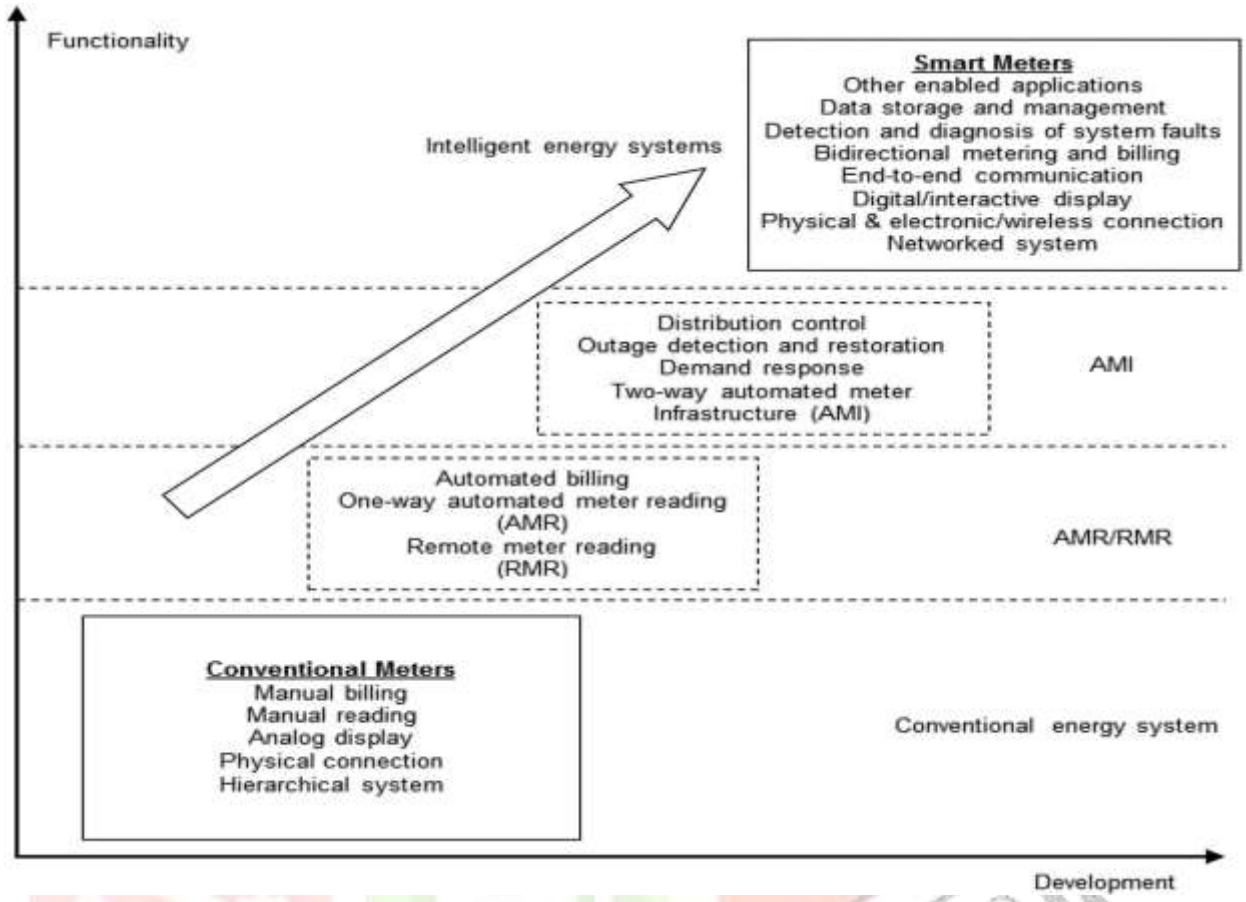

Fig 1: Development of smart energy meter and key functions

III. DEPLOYMENT OF SMART ENERGY METER

Before smart meters, conventional electromechanical meters were the main type of devices for measuring electricity flows. Measured data are usually displayed on an analog counter and have to be manually recorded. Smart meters are electronic devices that measure energy Consumption and operate two-way communication regarding the information of the energy consumption and billing and the status of energy networks. The capability of operating two-Way communication is the most important feature that distinguishes conventional meters and smart meters. It should be noted that there is no cutting the edge between conventional and smart meters and the development of smart meters is a progressive the process, like many other technologies. The first generation of smart energy meters was capable of operating one- way communication, i.e., reporting energy consumption back to utilities. The meters were used in the so-called automated meter reading (AMR) and remote meter reading (RMR) systems, i.e., one-way remote reading systems that allow utilities to read data over long distances [9]. After that, utilities further invested in the advanced metering infrastructure (AMI) in order to stimulate demand-side management, and the development of AMI was an important step toward IENs [11]. Recent development in smart electricity meters, as well as in the infrastructure of IENs, enables the following functions [9], [10], [11]:

1) Two-way end-to-end communication;
2) Automatic and bidirectional metering and billing customers accordingly;
3) Appliance monitoring and control;
4) Detection and diagnosis of system faults, e.g., outages;
5) Data storage and management;
6) Other more complicated applications, e.g., demand-side management, detection of electricity theft, enhancement of system security, load management and emission control, and development of smart urban cities.

IV .FUNCTIONS OF SMART ENERGY METERS

Based on the function of two-way communication, many more comprehensive functions have been developed and added into smart electricity meters. As a result, these improvements greatly extend the applicability of smart electricity meters.

A. Regular and Precise Metering

Regular and precise metering is the most basic function of an energy meter. The present development of IENs usually requires smart meters to operate metering hourly or even more frequently. For example, the American utility PG&E offers metering systems that read consumption data every hour by default [12], and the electricity meters provided by British Gas for residential use operate on a half-an-hour interval [14].

B. Data Recording and Alarming

Another common function, which is directly related to regular and precise metering, is to record the data and send alarms accordingly. Data recording and alarming is important for utilities to monitor the status of energy networks and useful for consumers to know the details about their energy use [58]. An example of this function is the integration of prepayment into metering systems, which has been very popular in Chinese residential areas and university campuses.

C. Two-Way Communication

Two-way communication has been considered as the most fundamental function of smart energy meters. Two-way communication refers to interactive communication between end-users and utilities/service providers, between utilities/ service providers and utilities/service providers, and even between end-users and end-users. Smart energy meters should contain a communication module, which is responsible for transmitting measured data and instructions to take specific actions [15]. In order to improve the reliability of a meter, the communication module usually operates independently of other functions such as metering, data recording and alarming.

D. Appliance Control

With the ability to operate two-way communication, smart electricity meters can transmit not only measured data, but also specific instructions to control appliances. The function of appliance control allows consumers and utilities/service providers to activate or deactivate a specific appliance according to the status of the electricity grid.

V.BENEFIT AND COST OF SMART ENERGY METER

Application of smart meters in the energy networks can generate numerous benefits for various stakeholders.

Stake Holder	Benefits
Customers	• Better access and data to manage energy use • More accurate and timely billing • Improved and increased billing options • Improved outage restoration • Improved data quantity and quality on power quality
Billing Services and security	• Reduced back office rebilling • Detection of interruptions and energy theft • Improved billing accuracy
Utility	• Reduced regulatory complaints • Improved customer premise safely and risk profile • Improved employee safety
External Stake Holders	• Improved environmental benefits • Support for smart grid initiatives

Table 1: Benefits of the application of Smart energy meter

VI. GSM

Global System for Mobile Communications (GSM) is the world's most popular standard for mobile telephony systems .GSM is used by over 1.5 billion people across more than 212 countries and territories. GSM also pioneered low-cost implementation of the short message service (SMS) which allows parties to exchange delay tolerant short text messages. The popularity and wide coverage of cellular networks have attracted researchers to consider the use of SMS service. GSM network such as scalability, reliability, and security, especially under high load. SMS delivery success rate was found to be 94.9%; 73.2% of the successfully delivered messages reach to the destination within 10 seconds; about 5% of them require more than an hour and a half. GSM uses several cryptographic algorithms for security. The development of UMTS introduces an optional Universal Subscriber Identity Module (USIM), which uses a longer authentication key to give greater security, as well as mutually authenticating the network and the user [16].

V. CONCLUSION

The progress in technology is a non-stop process about electrical distribution network.
In this paper, an automatic meter reading system based on SMS which includes the power consumption and corresponding amount will be sent to the respective consumers and the controlling base station Different firmware and hardware unit of the meter is described .This project reduces the manual effort and also saves time consumption, also maximizes profit for the base station working in electrical distribution network. The use of GSM in this system has many advantages. Data transmission is charged at standard SMS rates, thus the charges are not based on the duration of data transmission.
Revision of charges which is done yearly once will be done by authorized person at the base station only, which also reduces manual efforts. In this wireless meter reading system is designed to continuously monitor the meter reading. It avoids the human intervention, provides efficient meter reading, and reduces the maintenance cost.

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