

Remote Power Monitoring, Computing and Controlling through GSM Network

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Abstract: The development of a GSM Automatic Power Meter Reading System is presented in this paper. The GSM based Automatic Power Meter Reading System consists of electro mechanical Power Meter which is installed at every consumer side and Electricity e-Billing System at Electricity Board side. The GSM Power Meter is electro mechanical meter with embedded GSM modem which utilizes the GSM network to send the SMS. At the Electricity Board side an e-billing system is used to manage all the received SMS meter readings, compute the billing cost, update the database, and publish the notification to respective consumer through SMS and Website. The complete system is made up of a GSM electromagnetic Power Meter (GPM) installed in every consumer's unit and SMS Gateway, Application Terminal, Database Server and Web Server install at energy provider side. The System is working with GSM network to retrieve the power meter reading using SMS. The GPM is electromagnetic power meter which utilize the GSM network to send SMS back to provider. The GPM is integration of single phase power meter with GSM modem. A SIM card with a unique special number is require for GPM to receive and reply its meter reading to provider using SMS. Use of GSM (Global system for Mobile Communications) in the proposed system provides the numerous advantages of wireless network systems. The Electricity board saves money by the control of theft in energy meter and also more beneficial for customer side and the Electricity board side.

Keywords: GSM Automatic Meter Reading, Short Messaging System, Web Portal.

INTRODUCTION

Now a day the automation in every field is becoming necessary. This system aims to move away from the traditional method of manual reading of electricity meters in which an individual has to physically record the readings. This requires huge number of labor operators and long working hours to achieve complete area data reading error as sometimes the houses electric poser meter is place in a location where it is not easily accessible. Labor billing job is some time also restricted and slowed down by bad weather condition. This method of electricity consumption has the following disadvantages: meter readers are required to note down meter reading of each meter. The errors may occur while noting down meter reading [1]. Then errors may also occur while processing paid bills and due bills [2]. After generating electricity bill again man power is required to deliver all those bills [3]. So we need some system which can eliminates all problems present in traditional energy billing system. Automatic Meter Reading is to increase the accuracy reading system for customers and Electricity board. The complete system is made up of a GSM electromagnetic Power Meter (GPM). The GSM technology used to transmit the meter readings to the customers and to the Electricity board with the accurate cost. This process will happen for Two months (60 days) once transmission between customer and Electricity board. In addition to that the system also computes the billing cost, update database, and publish the details to respective consumer through SMS and Website. Use of GSM in the proposed system provides the numerous advantages of wireless network systems. The Electricity board saves money by the control of theft in energy meter and also more beneficial for customer side and the Electricity board side.

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REVIEW OF RESEARCH AND DEVELOPMENT

A. International Status

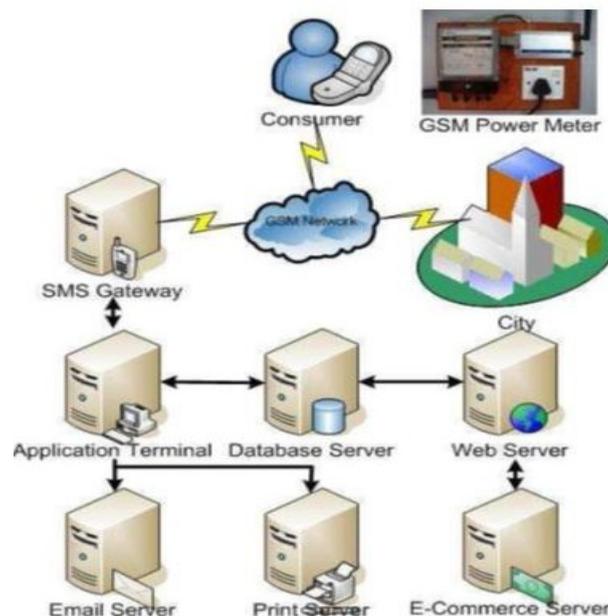
H.G. Rodney et al [1] have developed GSM Automatic Power meter reading system. This system contains GSM digital power meter installed in every consumer unit and electricity e-Billing system at the energy provider side. The GSM digital power meter sends the power meter reading to the energy provider and then e-Billing system present at energy supplier side calculates the electricity bill.

B. National Status

The Uttar Haryana Bijli Vitran Nigam has taken a major step in automation of metering and billing (AMR) of 3,200 high tension industrial consumers in the command area of the Nigam. The area comprises the following districts: Panchkula, Ambala, Yamuna Nagar, Kurukshetra, Kaithal, Karnal, Panipat, Sonapat, Rohtak, Jhajjar and Jind. The implementation of the AMR contract has been awarded to Tata Consultancy Services (TCS). The project is based on latest GPRS technology and is the first of its kind in northern India except Delhi, where a group of consumers were being covered by the New Delhi Power Ltd. Under this ambitious project, GPRS modems will be installed in each high-tension industrial consumer's premises. The data of the meter will be transferred to the server installed in the head office at Panchkula through these modems. With the implementation of the project, the meter reading shall be transferred online to the headquarters. Mr. Rahul Sarangle et al [2] have proposed GSM based power meter and control system. This system keep track of the meter reading of each day and SMS containing meter reading of each day is send to consumer as well as electricity department. Abhinandan Jain et al [3] have also proposed same system.

SYSTEM OVERVIEW

The complete system is made up of a GSM electromagnetic Power Meter (GPM) installed in every consumer's unit and SMS Gateway, Application Terminal, Data base Server and Web Server install at energy provider side. The System is working with GSM network to retrieve the power meter reading using SMS. The GPM is electromagnetic power meter which utilize the GSM network to send SMS back to provider. The GPM is integration of single phase power meter with GSM modem. A SIM card with a unique special number is require for GPM to receive and reply its meter reading to provider using SMS.



OVERVIEW OF SYSTEM ARCHITECTURE

Figure 1: Overview of GSM AMR System

After completion of meter reading request, the application terminal will start to retrieve meter reading from SMS gateway to store and update the database server. So after that the application terminal e-Billing system will start to calculate the billing amount for individual meter based on the tariff rate from energy provider. The billing notifications are resent to all the owners through SMS. A Web portal has already been setup at Web server to provide easy check and payment service. Once the owner received billing notification from SMS, then the owner can access web portal and able to logon to check their billing

details since the web server linked to database server. The owner can also use their mobile phones to retrieve their power meter reading to verify the billing reading.

The GSM technology used to transmit the meter readings to the customers and to the Electricity board with the accurate cost. This process will happen for Two months (60 days) once transmission between customer and Electricity board. In addition to that the system also computes the billing cost, update database, and publish the details to respective consumer through SMS and Website. A web portal has also been setup at the web server to provide SMS, email or hard copy printing bill then the owner can access the web portal and able to logon to check their billing details. The owner can choose to pay their bill online using credit as the web server is connected to the e-commerce server that is handling online banking transaction. With this feature the consumer can monitor their power usage anytime and anywhere.

COMMUNICATION INTERFACE

To send SMS we need communication interface between the automatic meter and database server. So we have use one technology for communication.

GSM (Global System for Mobile Communication)

GSM has been the backbone of the phenomenal success of mobile communication in the previous decade. Now at the dawn of true broadband services, GSM continues to evolve to meet new demands. GSM is an open, non-proprietary system with international roaming capability.

GSM is a cellular network which means that compatible devices connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network via Macro [1], Micro [2], Pico [3], Fenton [4] and Umbrella cells [5]. The coverage area of each cell varies according to the Implementation environment.

GSM POWER METER DESIGN

The design of the GSM Power meter an integration of a single phase class 1, IEC61036 standard compliance digital kWh power meter, Power to communication interface board and a GSM Modem.

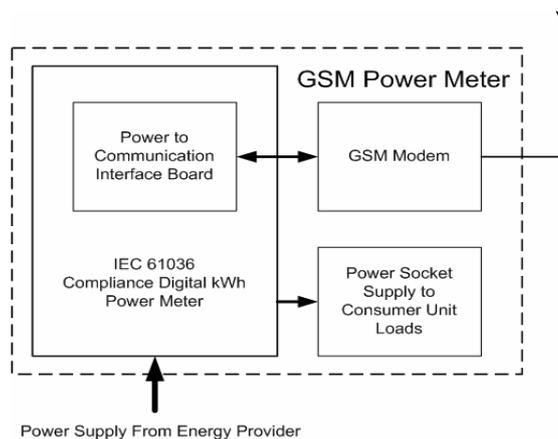


Figure 2: Block Diagram of the GSM Power Meter



Figure 3: GSM PowerMeter

The GSM digital power meter is used to measure the power consumption drawn from the energy provider substation to the consumer unit in kWh unit. The power to communication interface board was implemented by two RISC microcontrollers, on the power side the power micro controller to used to

interface the impulse and synchronize count form the power meter optocouple circuit and store the meter reading into its internal non-volatile EEPROM memory at every single impulse count interval. In the event of power failure the last meter reading information is stored in the EEPROM.

METHODOLOGY & EXPECTED RESULT

SMS and E-Mail Service

In this methodology we will decide how to send SMS and E-Mail from consumer side to

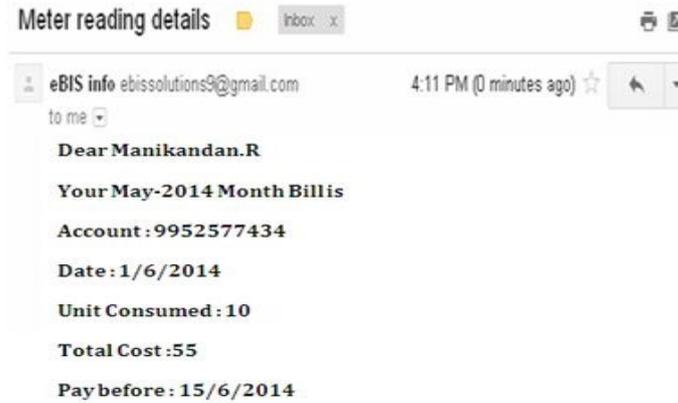


Figure 4: The Monthly Bill Mail received by customer from server

Electricity Board side and from Electricity Board side to consumer side. The server sends the E-mail and SMS of calculated bill of each and every month to the customer at end of the bill date and month. The mail is shown in Fig.4

The Monthly calculated bill details SMS get send to the customer. The SMS is shown in Fig.5



Figure 5: The Monthly Bill SMS received by customer from server

E-Billing Information System (e- BIS)

The GUI Electronic Billing Information System (E- BIS) is developed in visual studio 2005 with database establishment in SQL Server 2005 is shown on Fig.6



Figure 6: GUI for the eBIS System

Web Portal Design

It is required to design web portal so that consumer can see all information related to electricity board. The web portal allows the customer to check and print their billing information and details through the use of internet.

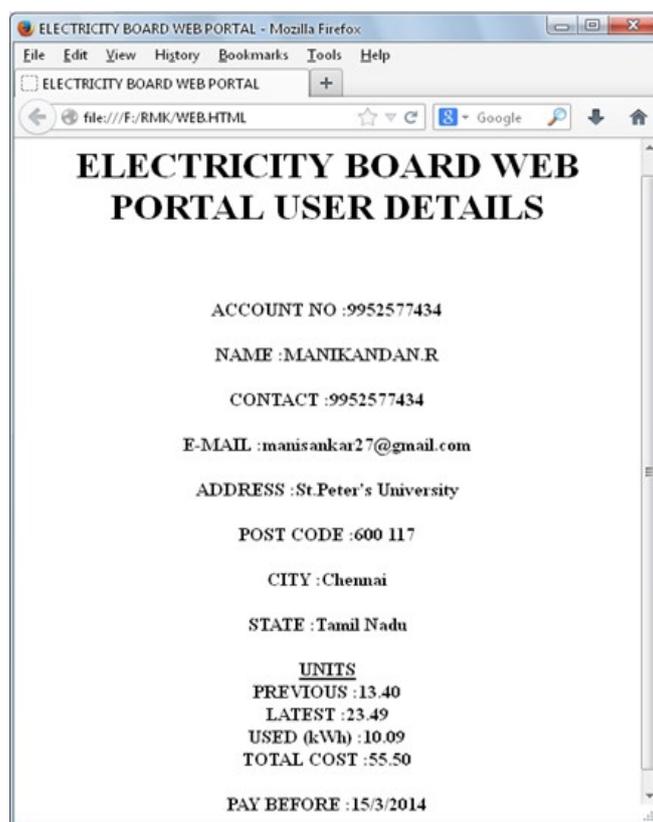


Figure 7: Web Portal Design

The web portal also allowed the customer to pay the bill online using credit card as the web portal link to the bank E-Commerce server for online transfer. Once the customer received the billing notification the customer can check and made payment online through the web portal. Fig.7 shows the customer details and billing information after login the web portal.

CONCLUSION

As the system name suggests, the vision of proposed system is to provide an automated environment for the purpose of meter readings and thus reduce the dependency on human resources. Thus the 'Automated meter' would be the representative of the company for the purpose of taking readings without involving human errors. Use of GSM in our system provides the numerous advantages of wireless network systems. The Electricity board saves money by the control of theft in energy meter and also more beneficial for customer side and the Electricity board side. The metering ensures the accurate and reliable measurement of power consumed.

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