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A Smart Wireless Electronic Energy Meter Reading Using Embedded Technology

Shraddha Male[1], Pallavi Vethekar[2], Kavita More[3], Prof. V. K. Bhusari[4]
[1](JSPM's BSIOTR (W), Pune University, India)
[2] (JSPM's BSIOTR (W), Pune University, India)
[3] (JSPM's BSIOTR (W),Pune University, India)
[4](JSPM's BSIOTR (W),Pune University, India)

ABSTRACT
The AMR (Automatic Meter Reading) system is a system used for reading energy consumption remotely. This wireless AMR system is based on wireless network and embedded technology to solve the problems in existing AMR system. This paper presents the simple low cost wireless GSM energy meter and it has remote access of existing meter. It saves huge human labour. A GSM based wireless module for communication is integrated with electronic energy meter and it has remote access over the usage of electricity. Authentication is provided to users for accessing the developed web pages details from anywhere in the world. So GSM based wireless AMR system is more effective approach for convention of billing system. This system also provide authority to electricity companies to take actions against lenient customers who have outstanding dues, otherwise company has right to disconnect the power supply and also it can reconnect power supply after deposition of dues. The complete monthly usage of electricity and due bill is messaged back to the customer after processing these data. We finally thought of building such a system that will do the above process automatically.
Keywords – Automatic Meter Reading (AMR), Global System for Mobile Communication (GSM), Maharashtra State of Electricity Board (MSEB), Short Messaging System (SMS)

I. INTRODUCTION

There is incorporation of mobile technology into MSEB automation system due to the rapidly advancing mobile communication technology and the decrease in costs. We propose a system that collects the energy consumption from residential as well as corporate zones and send it directly to the central server where processing is done on that data for preparation of bills. AMR system can be divided into wire AMR system and wireless AMR system according to communication medium used. In existing system for collection of energy consumption data is that the representatives of MSEB monthly comes and visit every residential , take the snap shot and corporate and manually reads the consumption data from the meter. This collected data is recorded on a piece of paper along with a snap shot of the meter and finally submitted to the local MSEB office. There after the official's read the snap shot and meter readings and then gives it to the local software for bill calculations and generation of bill. We as a consumer then make the payment for the received bill. This process is so much hectic process. Man made mistakes can be countless. Human resources wasted and many other problems do occur. We finally thought of building a system that will do the above process automatically. Microcontroller is attached with our traditional energy meters that will scan the meter reading after particular period. Wirelessly, these meters reading will transmitted to the centralized server along with their unique meter number. This data will be processed by the server and automatically generates the bill. After generation of bill it will send to every consumer via SMS facility.

II. LITERATURE SURVEY AND RELATED WORKS

For measuring the usage of the consumption of energy electronic meter or electromechanical meter is fixed in existing system. Currently the meters take the recording kWh units. There are many AMR systems which are based on GPRS, Bluetooth, GSM technology. For long distance data transmission GPRS is used but it is impossible to implement as still the regular use of GPRS is not possible to common people. In GSM technology instant billing system is introduced but there may be chances of missing SMS which decreases system performance but in proposed system this problem is overcome.

III. SYSTEM ARCHITECTURE

In proposed system, we replaced the traditional meter by metering module which consist of metering IC and microcontroller which scans the energy meter automatically after every month and transmits this collected data to the remote station

through the GSM network. After receiving this data is stored in the database and process on it for the creation of bills. As soon as bills are generated, it will send to the consumers via GSM network.
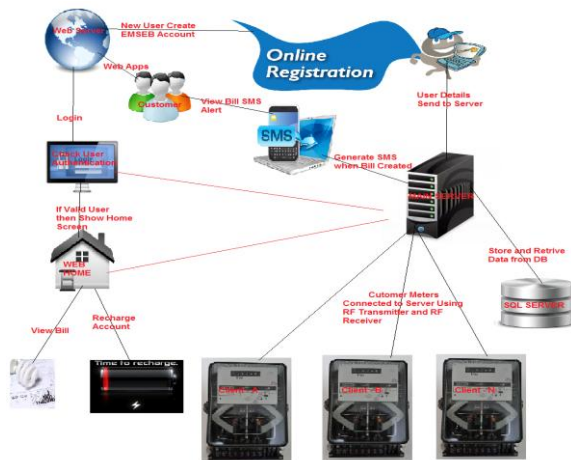

Fig.1 Overview of the Proposed System

IV. SYSTEM DESIGN

This GSM energy meter is constructed using the microcontroller, a display, GSM modem and microchip. In this, meter is designed using embedded GSM modem and by using existing GSM network to send wirelessly its energy consumption value as SMS to energy provider. At the time of sending the message every time, this data is stored in the non-volatile memory (EEPROM). We use RTC module also with meter to have all recording of usage details about energy consumption. In the office, the this GSM unit will receive these collected data and local software will process on that data and calculate the total power consumption of each user. The system design can be discussed as two broad categories, Hardware implementation and software web portal design implementation.

4.1 HARDWARE IMPLEMENTATION

In this system power supply is provided to meter. A GSM unit shows the interfacing with the microcontroller. Transmission of usage details is send to office modem using user modem. Every consumer has unique number provided by corresponding authority. Hardware implementation includes following points as discussed below.
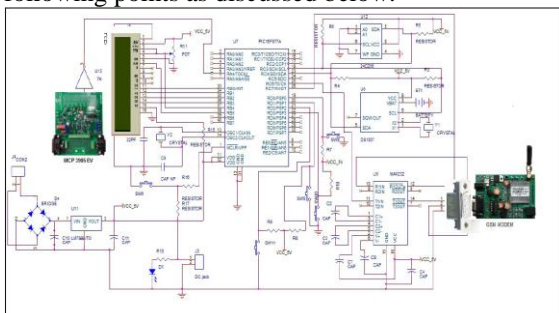

Fig.2 Circuit Design of Energy Meter

4.1.1 POWER SUPPLY

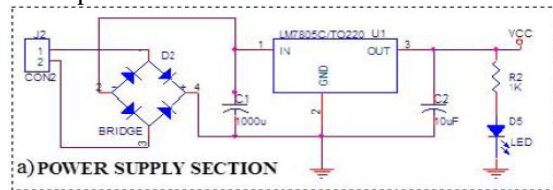Power supply is provided to microcontroller and other device from direct ac lines or from AC to DC adapter.

Fig.3 Power supply circuit

4.1.2 EXTERNAL EEPROM MEMORY

This EEPROM memory device is used for storing the data in the form of amount of unit the user consumed the energy at the time of transmission of SMS i.e. for off line process.

4.1.3 REAL TIME CLOCK (RTC)

RTC is used mainly for maintain the real time and date in the state of the system when power supply is off. RTC used for this system is DS1307 as it can run long years and also it has low cost.

4.1.4 IMPLEMENTATION

In The metering IC creates the output in the form of pulses which are counted using the default timer of PIC microcontroller unit. These pulses are identified by the transition of high and
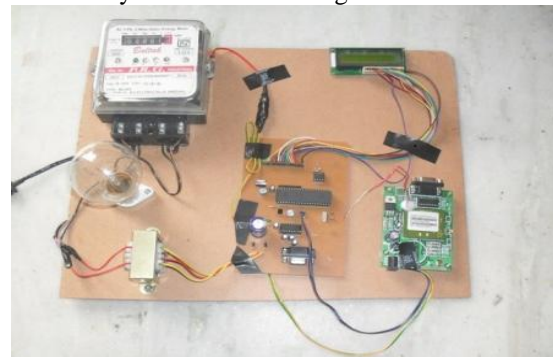

Fig.4 Practical Setup of Transmitter Prototype

low voltage of the automatic voltage regulator. A TTL inverter circuit is used to reverse the produced pulse before applying to the counter. For reading the data from the metering IC, microcontroller is programmed using software interfacing. When microcontroller reads the energy usage, this data is stored and updated in software. In this, meter is measured for 1 unit of energy consumption and it creates 3200 pulses in LED.

Transmitter prototype developed using meter circuit as shown in Fig.2 and its practical set up is shown in Fig .4. PCB layout and orcad suite are used. The final design and assembly of proposed meter is shown in Fig.5 which is handy tool and has less weight. On the top of the meter, there is 20x4 LCD display used for displaying reading. And RTC

is used to update time date information. EEPROM is used to stored the content.

4.2 SOFTWARE DESIGN IMPLEMENTATION

In software design part we have created web portal design. In this users are categorized as consumer and staff. Any time any where user can login using login option. Administrator can perform various tasks like registration, updating the database, message setting. Using serial port/ USB admin can connect the GSM modem to web portal. For that initially hardware setup is required then selecting particular port admin can connect to the system. For receiving SMS from meter. It is disconnected only when administrator disconnects it. Registration of consumers, preparation of bills is performed in this part.

4.2.1 AUTOMATIC BILL SOFTWARE

For managing all SMS readings, e-billing, updating the database we created web oriented GUI. It computes monthly bill, notify it to consumer through SMS facility and authority is provided for preparation of bills and analysis of collected of data.

Fig.5 Home page

Fig.6 User Registration and User Details

Net Beans 7.0 is used as integrated development environment with java framework .It is used to develop GUI and applications with the window form applications, websites, and web applications with proper coding. For this system source code is written in java. Once it is hosted user can access it through internet. In this application, we categorized users as a administrator and consumer. Administrators have various facilities like View customer details, View bill history and Add scratch card. New users have online registration facility through he/she gives all required details which is

stored in database. Consumer also have various facilities provided like View current bill, View bill history, Recharge account, View account balance and Change password.

V. CONCLUSION

Different Electronic meters have been developed at the higher level. The GSM networks plays an important role because it has good coverage facility and to manage fault tolerance. In this system, it manages the energy flow. The proposed system is highly effective as it provides security, accuracy at the higher level. SMS rates are standard for sending message to every consumer as per their electricity usage. The collected data is transmitted to the centralized sever in very fast manner therefore this system will be able to calculates the bills instantly.

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