



GSM BASED AUTOMATIC ENERGY METER READING SYSTEM WITH INSTANT BILLING

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ABSTRACT: The technology of e-metering (Electronic Metering) has gone through rapid technological advancements and there is increased demand for a reliable and efficient Automatic Meter Reading (AMR) system. The proposed system replaces traditional meter reading methods. It enables remote access of existing energy meter by the energy provider. A GSM based wireless communication module is integrated with electronic energy meter of each entity to have remote access over the usage of electricity. A PC with a GSM receiver at the other end, which contains the database acts as the billing point. Live meter reading from the GSM enabled energy meter is sent back to this billing point periodically and these details are updated in a central database. Authentically, users can access the developed web page details from anywhere in the world. The complete monthly usage and due bill is messaged back to the customer after processing this data. 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. So we thought to build such automatic system.

Keywords- *Automatic Meter Reading (AMR), Global System for Mobile Communication (GSM), Short Messaging System (SMS), Radio frequency (RF).*

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. 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. wireless local area network (WLAN) links two or more devices using some wireless distribution method and usually providing a connection through an access point to the wider Internet. This gives users the mobility to move around within a local coverage area and still be connected to the network. By using Wireless Body Area Network the users links the devices through their body and nearby devices. From the recent development in low power Wireless Sensor nodes in WBAN, the

applications are categorized into two as Medical and Non medical. In medical applications the vital data's are transferred through this wireless network which is used in prevent the occurrence and treat the diseases.

II. LITERATURE SURVEY

Subhashis Maitra (Oct 2008) In this paper, a new concept of energy meter will be discussed, where maximum demand of energy of a consumer will be indicated in the meter used by the consumer. After exceeding the maximum demand, the meter and hence the connection will automatically be disconnected by an embedded system inserted in the meter itself. According to the maximum demand, the consumer will purchase a cash-card of amount depending on the consumption of energy and after the full consumption, the consumer again has to purchase another cash-card or recharge the same and thus the hassle related to the billing office, to stand in a long queue and to submit the bill, can be avoided. Also this system helps to eliminate the drawbacks of billing management system, such as to take the reading from the meter, to create the bill, to print the bill, to send the bill to the proper address and to collect the amount for the bill [6].



T El-Djazairy, B J Beggs and I F Stewart (Jun 1997)

This paper presents the results of an investigation which show that the development of the GSM network as a low cost, global carrier of digital telecommunications signals provides exciting opportunities for novel applications such as the handling of power system metering and load management telemetry. As the use of GSM for telephony becomes more widespread, it is inevitable that costs will be driven lower, and it is also inevitable that this medium for the transfer of telemetry data will become very important to the electricity supply industry in the next few years. One major issue which will require to be addressed as this development takes place is the security protection of data being transferred, particularly in the radio link paths of the network.[7]

Li Kaicheng, Liu Jianfeng, Yue Congyuan, Zhang Ming: (Jun 2008) A power load management system based on ARM-7 microcontroller and GPRS is presented in this paper. The proposed system consists of electronic KWH meter, intelligent management terminal (IMT) and management centre. The intelligent terminal is used to acquire information from KWH meter, control the energy-consuming device and communicate with management centre via GPRS network. How to implement the IMT by using ARM-7 microcontroller and GPRS telecommunication module is discussed in detail. Also the software design of the terminal with high performance embedded real-time operating system $\mu\text{C}/\text{OS-II}$ is presented in this paper.[8]

P.K. Lee and L.L. Lai, Fieeee (Jun 2007)

In this paper, the authors discuss the way to adopt the cost effective GPRS applications. Although there have been lots of theories and concepts on the GPRS applications but the real applications applying to a large network, distributed power generation or building energy/power distribution monitoring are limited. The authors focus the application of the GPRS to this on-line system application and the techniques. A practical scheme is proposed and its use to real-life system will be introduced. A practical implementation for an wireless GPRS on-line Power Quality Monitoring System will be illustrated. Results and benefit to the end users in some practical applications will be discussed.[5]

H.G.Rodney Tan,C.H. Lee,V.H.Mok (Dec 2007)

The development of a GSM automatic power meter reading (GAPMR) system is presented in this paper. The GAPMR system is consists of GSM digital power meters installed in every

consumer unit and an electricity ebilling system at the energy provider side. The GSM digital power meter (GPM) is a single phase IEC61036 standard compliance digital kWh power meter with embedded GSM modem which utilize the GSM network to send its power usage reading using short messaging system (SMS) back to the energy provider wirelessly. At the power provider side an ebilling system is used to manage all received SMS meter reading, compute the billing cost, update the database, and to publish billing notification to its respective consumer through SMS, email, Web portal and printed postage mailing. A working prototype of the GAPMR system was build to demonstrate the effectiveness and efficiency of automatic meter reading, billing and notification through the use of GSM network.[2]

In view of the narrowband carrier communication widely used in the automatic meter reading system in low voltage power line of our country at present, this paper proposed the automatic meter reading system's design scheme based on the microcontroller, this controller overcame the narrowband carrier communication bandwidth to be excessively narrow, the speed to be excessively low, real time badly ordering Electricity via Internet and its Potentials for Smart Grid System.

The Internet has evolved into a ubiquitous communication medium for information exchanges, services requests, and commodity purchasing. This paper proposes the concept, architecture, the smart meter reading system and automatically generation of bills consumption of energy in electronic meter and electromechanical meter is fixed in existing system. Currently the meters take the recording kWh units. AMR system is based on GPRS, Bluetooth, and 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 to use. 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 by using database Management.

III. SYSTEM ARCHITECTURE

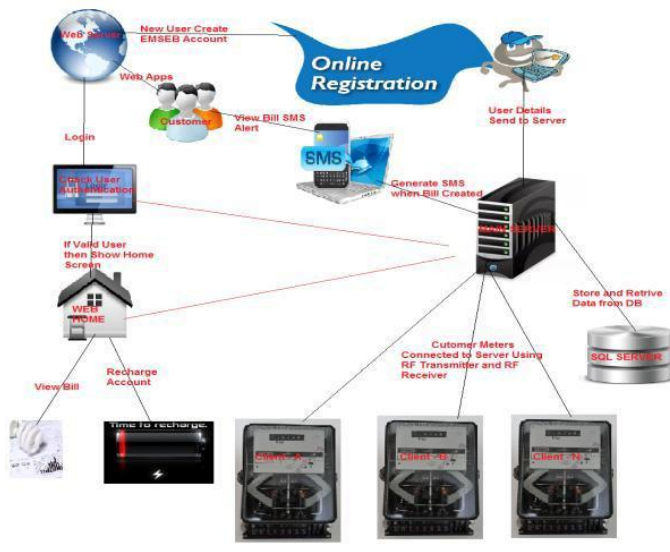


Fig.1 System Architecture

The proposed system is most effective and secure. In this proposed system, the traditional meter which are existing now a days are replaced by metering module which consist of metering IC and microcontroller which scans the energy meter automatically without any error after every month and transmits this collected data to the central server through the RF transmitter and receiver.

This proposed system is actual uses client server architecture which includes single central server and so many clients which uses the smart meter. After receiving meter reading, this data is stored in the database and process on it for the creation of automatic bills. As soon as bills are generated, it will send to the consumers via GSM network.

IV. DESIGN OF SYSTEM

The microcontroller, a LCD display, GSM modem, MAX232, USB-to-serial port cable for compatibility purpose and microchip are used for constructing the GSM energy meter. In this, meter is designed using embedded code and AT commands which controls our GSM modem for sending messages to every client’s mobile number when administrator takes meter reading after every month.. At the time of sending the message every time, this data is stored in the non-volatile memory (EEPROM). We use real time clock module also with meter to have all recording of usage details about energy consumption. In the office, this GSM unit will receive these collected data and local software will process on that data and calculate the total energy consumption of specific meter of each

user. The system design can be discussed as two broad categories, Hardware implementation and software web portal design implementation.

4.1 IMPLEMENTATION OF SOFTWARE DESIGN

In software design, we have created web application which creates the interfacing with users. In this users are categorized as consumer and administrator. The user can easily login into system using login option. This login option is actually used when users are already done their registration which uses the smart meter. Administrator can perform various tasks like controlling on the system, registration, updating the database, message setting. Using serial port/ USB admin can connect the GSM modem to web application. For that initially hardware setup is required then setting particular port of GSM modem and USB-to serial port, admin can connect to the system. For receiving SMS from meter. It is disconnected only when administrator disconnects it. Registration of consumers, view of bill’s history, current bill of every consumer etc are done in this part.

4.1.1 AUTOMATIC GENERATION OF BILL SOFTWARE

In this proposed system, we have created one mathematical model for generating the bill automatically without any mistakes in a very few time. After this, the bill is sending on mobile numbers of consumers. 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 which is given to the administrator.



Fig 2 Home Page

Fig. 2 shows the home page of this system. There includes login sections for admin and user It includes First Home Page appears on the display screen as soon as system is started then it includes Welcome message and shows various facilities whichever system provides like Login, Online registration facility for new users. And it displays various services.



4.2 COMPONENTS OF HARDWARE IN SYSTEM

The components of hardware implementation are as follows:

4.2.1 REAL TIME CLOCK

The RTC is actually useful for updating the data, information of especially time and date which includes seconds, hours. This RTC always updates the date and time when power supply is not given i.e. in offline process.

4.2.2 EEPROM AND RELAY

This extendible EEPROM memory device is used for storage of information in the form of amount of unit which are consumed by the specific meter of any consumer. It is also stores the data in offline process. The relay is always used for the automation systems. The relay is used as a switch for the system.

4.2.3 POWER SUPPLY

Power supply is main component of the meter. Power supply is provided to microcontroller and other device from direct ac lines or from AC to DC adapter.

4.2.4 MICROCONTROLLER

The ATMEL microcontroller AT89C52 and AT89C2051 are used in proposed system which are discussed as follow shortly.

AT89C52

AT89C52 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89C52 is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM).

AT89C2051

The AT89C2051 provides the following standard features: 2K Bytes of Flash, 128 bytes of RAM, 15 I/O lines, two 16-bit timer/counters, a five vector two-level interrupt architecture, a full duplex serial port, a precision analog comparator, on-chip oscillator and clock circuitry.

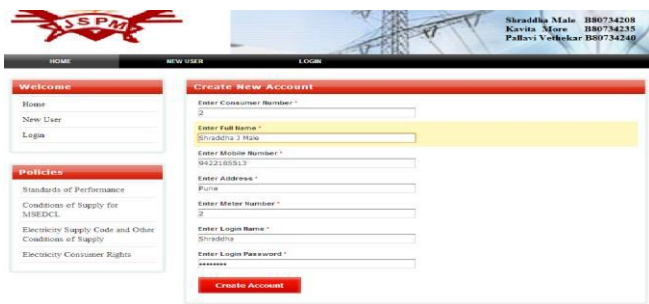


Fig. 3 Registration form

Fig.3 shows registration form for new users there is online registration facility in which user fills all his details

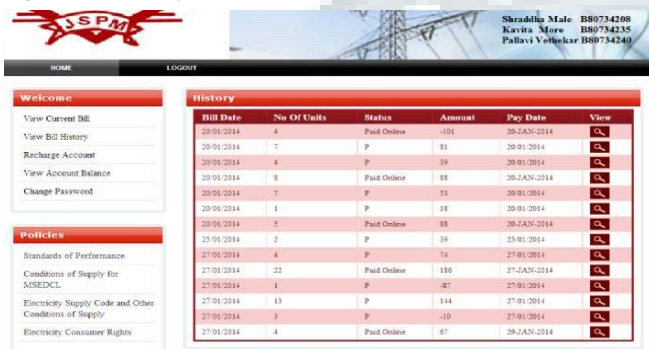


Fig.4 shows facility for view the Bill History. Bill History shows all details.

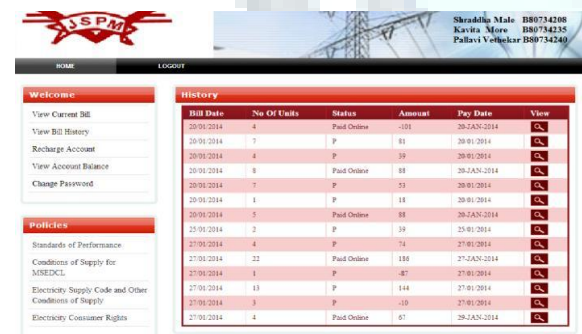


Fig.4 Bill details

Fig.5 shows that snapshot of form after user login it displays various services to user like Bill information in which he can see his current bill including all details.



Fig.5 View current bill

4.3 HARDWARE IMPLEMENTATION

In this system power supply, GSM modem, relay, transformer, registers, capacitors are the main components which are used for implementing the smart meter. The power supply is always provided to the meter in which we can give the load on bulb for practical set up. A GSM unit shows the interfacing with the microcontroller. For this system we use the microcontrollers AT89C52 and AT89C2051 which are from the AVR family. The MAX 232 chip is also used for the compatibility purpose in interfacing of different components. Transmission of usage details is send to central office using RF transmitter. Every consumer's meter has unique meter number provided by corresponding authority.

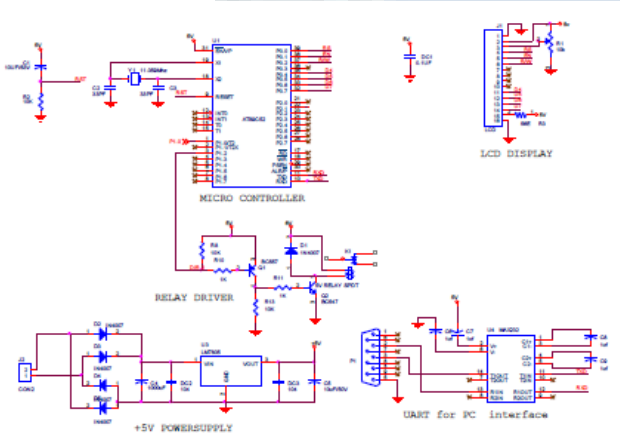


Fig.6 Circuit diagram



Fig.7 Practical design of system

When the power supply is given to the meter, the metering IC creates the output in the form of pulses which are counted using the default timer of AT89C52 microcontroller unit. These pulses are identified by the transition of high and low voltage of the

automatic voltage regulator. A TTL inverter circuit is the main circuit which 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 with the help of Keil software. 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.

The final design and assembly of proposed meter is shown in Fig.9 which is handy tool and has less weight. On the top of the meter, there is 16x2 LCD display used for displaying reading. And RTC is used to update time date information. EEPROM is used to store the content. Relay is used for on and off the bulb automatically from the administrator. We used different capacitors, registers, potentiometer, oscillators, and wires for implementing the practical set up of proposed system.

V. CONCLUSION

Proposed system is highly effective in penalizing man work and making the system fully automatic. Hence the probability of error is negligible. Using wireless communication is very big boon which enables instant billing. In future this system can be utilized throughout the world as communication is done by GSM which is a universal standard. This system monitors the flow therefore consumer only pay for what his usage. This system is highly effective system. Various electronic meters have been developed and are still being developed. Data transmission is charged at standard SMS rates, thus the charges are not based on the duration of data transmission. The cost efficient transmission of readings ensures that power consumption values can be transmitted more frequently to a remote station. A soft copy can be send to the consumers e-mail if consumer is registered with his e-mail address .The same idea can be expanded to water and gas meter reading system by proper modification. The designed web portal options can be added to the existing web page of any energy provider worldwide and it can be hosted for public. If energy provider is willing to add online payment options in the hosted web page, instant payment by the consumer from anywhere in the world is also possible.



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