ADVANCE LOW COST ELECTRICITY BILLING SYSTEM USING GSM

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ABSTRACT
Electricity is one of the fundamental necessities of human beings, which is commonly used for domestic, industrial and agricultural purposes. There lots of problem in distribution and metering. The wireless meter promise fast and accurate billing system. The traditional electro-mechanical meters, still widely used today are prone to drift over temperature and time as a result of mechanical nature of the components in the meter. The problem worsens further in collecting the meter readings and generating the bill. In this paper, technique for Prepaid and postpaid scheme using SMS has been illustrated. GSM network is used for sending and receiving SMS.

KEYWORD
GSM Modem, Microcontroller, Server, and Wireless Meter.

I. INTRODUCTION
The current system of Electricity billing is error level and also time consuming. Errors introduced at every stage are fond of errors with electro-mechanical meters, human errors while noting down the meter reading, and errors while processing the paid bills and the due bills.

The major disadvantage of a post paid system is that there is no control of usage from the consumer’s side. There is a lot of wastage of power due to the consumers be short of of training of electrical consumption in an well-organized way. Since the supply of power is limited, as a responsible citizen, there is a need to use electricity in a improved and efficient way. There are clear domino effect from many countries everywhere a prepaid system has reduced the usage (wastage) by a great quantity. Additional advantage of the prepaid system is that the human errors made reading meters and processing bills can be reduced to a great amount. Wireless meter can be used in residential apartments and especially in industrial consumers where bulk energy is consumed [1].

Advance in wireless technology have made exchange of information is very high-speed, protected and truthful. Advance in wireless technology caused rapid change in field of telecommunication system. Communication system like internet and GSM are available in India. In this paper presented here the technique has been developed prepaid scratch card billing system for electricity. And also the Wireless metering the meter has sent the meter reading e.g. KWh to the base station. Base station designed for both system prepaid and postpaid.

The paper consist of following section: Section II: implementation single phase wireless energy meter. The system includes energy metering IC, Microcontroller which communicates to the server through GSM modem for both prepaid and postpaid scheme. Server accepts the request or sends the request to wireless meter.

Prior Art
Major developments and projects in the field of remote metering are in progress, involving various research and development programs such as PLCs, application of the system on large databases, utilization of the necessary communication links, and others. Above system is inflated that’s it is not castoff in India as consider Indian frugality.
I. IMPLEMENTATION

The system consists of wireless meter and the server which is shown in fig 1. The wireless meter placed in homes, company and the buildings which have exchange the information using the GSM network through SMS. Both the prepaid and post paid system implemented using this architecture.

A. Wireless Meter

The metering module consists of a Microcontroller, metering IC, LCD i.e. liquid crystal display, EEPROM, Relay, GSM module and Keypad.

B. Microcontroller Unit

PIC microcontroller is used as main unit. The PIC is an 8 bit Reduced Instruction set computer (RISC) Microcontroller. It is one of the most popular microcontrollers for its high performance and low cost. It has three 8 bit ports, one 6 bit and one three bit port so total 33 I/O lines. Fig 2 shows block diagram of wireless meter. It has 8 KB of program memory and 368 data memory. The program inside the microcontroller contain the protocol for accessing different hardware peripheral such as LCD,EEPROM, Relay, Metering IC, GSM Module. And applications contain the billing calculation and send the SMS.

C. Display Unit

16x2 Character LCD is interfaced with microcontroller using 4 wire modes. The meter reading i.e. KWh, total KWh, cost KWh, last billing date (Post paid scheme) and remaining KWh in prepaid scheme etc.

D. Metering Module

The metering module (ADE 7757) is used. The ADE 7757 is mixed signal single phase metering IC. It supplies average real power information on the low frequency outputs F1 and F2. These outputs may directly drive the electromechanical counter or interface with MCU. The frequency output CF is connected to a microcontroller pin. This will count the number of pulses in given time. The average power proportional to the average frequency is given by

\[
\text{Average frequency = Average power = Counter/Time}
\]

Energy consumed during the integration period is given by

\[
\text{Energy = Average Power x Time = (counter/ time) x time}
\]

The ADE 7757 calculates the product of two voltage signals (on channel V1 and V2) and then low-pass filters this product to extract real power information. This real power information is then converted to a frequency. The frequency information is output on F1 and F2 in the form of active low pulses. The result is an output frequency that is proportional to the average real power. [3]

E. Relay Unit

A relay is used for connecting and disconnecting power supply to the customer's load. The microcontroller sends signals to the relay input signal pins to control the relay contacts

F. GSM Modem

A GSM modem is interfaced with the microcontroller serial port for sending and receiving SMS. Using AT command Protocol, [2] microcontroller send the different commands to the modem. AT-commands which stand for ATTENTION TERMINAL are used by processing unit to communicate with the GSM Modem. This whole operation is based on the instructions that are passed by processing unit. This modem and the processing unit are linked by means of RS-232 communication protocol [4]. This operates under the following configuration,

- Baud Rate = 9600
- Parity Bit = None
- Byte Size = 8
- Stop Bit =1

Some of the main and frequently used AT-Commands are given below as also used in,

- AT (Attention Command)
- AT+CMGL (List message)
- AT+CMGF (Selecting messaging mode)
- AT+CMGS (Send message)
- AT+CMGR (Read message)
- AT+CMGD (Delete message)

G. Keypad

A 3x4 keypad is integrated with meter module. Use full in prepaid mode. The key available on this keypad start from 0-9 and one enter key

II. CENTRAL SERVER

Server mainly consist of GSM Hardware unit and several software module which shown in fig 3.

It consists of GSM module which used for sending and receiving the SMS using AT command [2]. To
interface modem with server the MCU is used. Communication is done using the serial protocol. Server’s Serial port (RS 232) and 8051 with RS232 module used between them.

A. Server Software

Our system the central server is built on windows XP operating system with VB programming Language. The software composed several module which shown in Fig 3. The data communication module communicate to 8051 microcontroller through serial communication. Microcontroller 8051 is communicating to GSM through AT Commands. When server wants collect information from particular remote location meter, it send request SMS message to particular meter and wait for data from GSM module. After the remote meter receives the Request SMS massage, it makes a data frame consisting of the meter’s information and sends it to the server by SMS. The server then gets the SMS data from the GSM modem and stores the information in the Database. Fig 4 shows the flow chart of post paid billing system.

The data collection can be done at any time or periodically such as monthly basis. The Monitoring & Analysis Module gets data from the Database and calculates the overall energy consumption of the meter. Server operator can send Disconnection SMS massage to the wireless meter to disconnect the meters relay contacts and thus stop the customer to consume further energy. Pre-paid scratch-card based billing scheme can also be implemented using the SMS based technique.

The electric supplier will produce scratch-cards. Customers will buy scratch-cards and send the SMS through keypad included in Wireless meter to the central server consisting of the customer’s meter ID and the scratch-card’s secret pin number. When the central server receives the SMS, it checks the validity of the pin number from the database and meter ID. If the meter ID is valid and the pin number is also valid and still unused, then the server sends an SMS to the customer’s meter which contains the information of how much balance will be recharged in the meter. The meter receives the SMS, decode it and recharge the balance. Fig 5 shows prepaid billing system.

III. CONCLUSION

In this paper, an SMS based Wireless metering system has been proposed. Different hardware and firmware unit of the wireless meter is described. The central server’s different modules and the communication protocol with the wireless meters are also shown. We have illustrated both postpaid and prepaid billing scheme.

REFERENCES

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