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A VISION OF ENERGY METER THROUGH GSM BASED COMMUNICATION

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ABSTRACT

This paper presents a digital vision of energy meter through GSM based communication which is bridge between electrical control, protection and GSM service. This project has wireless gateway as GSM based power recharge interface which contains a prepaid card equivalent to mobile SIM CARD. In this project current is measured through a circuit. The output of this circuit is combination of analog and digital circuit whose output is given to the microcontroller [89C51]. Main advantage of this approach is reduced power theft and eliminate billing delay. Necessary program for micro controllers are written in C language.

KEYWORDS: Smart Card, DTMF [Encoder and Decoder], Microcontroller [89C51], Voltage Comparator

INTRODUCTION

Wireless prepaid energy Recent development have seen a move towards the implementation of electronic meters and the utilization of telecommunications systems for automated transmission of data to facilitate remote access energy management [1]. The Indian power sector faces a serious problem of revenue collection for the actual electric energy supplied owing to energy thefts and network losses. One of the prime reasons is the traditional billing system which is inaccurate many times slow, costly, and lack in flexibility as well as reliability [2]. Meters, in the past and today in a few countries, were electromechanical devices with poor accuracy and lack of configurability. Theft detection was also a challenge. Recent developments in this direction seem to provide opportunities in implementing energy efficient metering technologies that are more precise, accurate, error free, etc [3]. A Prepaid Energy Meter enables power utilities to collect electricity bills from the consumers prior to its consumption. The prepaid meter is not only limited to Automated Meter Reading but is also attributed with prepaid recharging ability and information exchange with the utilities pertaining to customer's consumption details. The use of electronic token prepayment metering has been widely used in UK for customers with poor record of payment [4]. A paper suggests a design of a system which can be used for data transmission between the personal computer and smart card [5]. A Prepaid Energy Meter enables power utilities to collect electricity bills from the consumers prior to its consumption. The prepaid meter is not only limited to Automated Meter Reading but is also attributed with prepaid recharging ability and making use of state of art technologies like WI MAX in Prepaid Energy Meter owing to the idea of centralized accounting, monitoring and charging [6]. Poly phase prepaid energy metering systems have also been proposed and developed based on local prepayment and a card reader [7]. Metering system has been proposed which incorporate RF based system [8]. Digital energy metering system as an alternative for the electromechanical system has been proposed and developed with the Peripheral Interface Controller (PIC) and necessary software [9]. Due to the low cost of microcontrollers, Prepaid Energy Meter has been developed using a microcontroller from the Microchip Technology Inc. PIC family [10]. The paper mainly deals with pre-paid energy meter which utilizes the features of embedded system which is the combination of hardware and software in order to implement desired

functionality [11]. Various AMR methods and technologies using power line carrier (PLC) communications super visionary control and data auiquisation (SCADA), internet, Ethernet, embedded RF module, WI FI, Bluetooth, ZIG Bee were established and developed to provide and demonstrate the solution of efficiency reliability and effectiveness of AMR. The above mention methods are either tool expansive to implement and operate, require complement set up of infrastructure short operating distant and still require field intervention of human operators or prone to error and reliable development of global system mobile GSM [12]. The GSM based recharge prepaid energy meter presented in this paper take advantage of available GSM infrastructure nationwide coverage in the country [12]. This paper organized as follows; detail description about hardware improvement in section 2and software improvement in section 3. In section 4 result is based on experiment and tests. In this paper conclusion is followed by Acknowdgement and references.

ARCHITECTURE OF PREPAID ENERGY METER

The system design of microcontroller based digital prepaid energy meter is shown in figure 1. The energy consumption is calculated by energymeter IC and Microcontroller [89C51]. Microcontroller based prepaid energy meter can be divided in several parts;Energy meter, Power supply, Relay driver, Voltage comparator, Microcontroller [89 C51], DTMF Decoder, LCD Display, Music generator and Smart card with mobile communication.
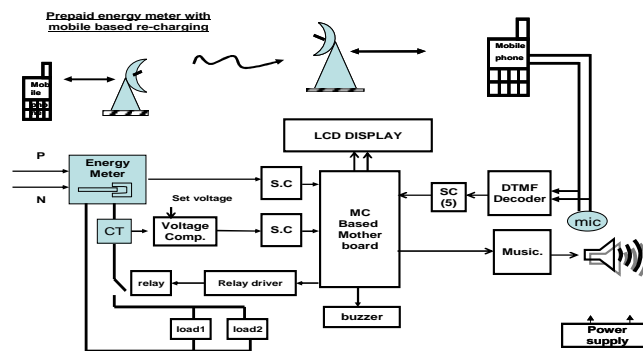

Figure 1

HARDWARE IMPROVEMENT

- **Power Supply Unit**

    Every electronic equipment need sufficient power for operation.

- **Relay Driver**

    The on and off is depend upon balance present in prepaid card.

- **Over Current Detector**

    In this section a special type of CT is used to detect very low current. The output of this CT is an AC voltage proportional to the Load current.

- **Microcontroller**

    The 89C51 is a low power high performance CMOS 8 bit microcontroller used as a motherboard.

- **DTMF Decoder**

IC MT870/KT3170 serves as DTMF decoder. This IC takes DTMF signal coming via mobile connection and converts that signal into respective BCD number.

- **LCD**

The HD44780U dot-matrix liquid crystal display controller and driver LSI displays alphanumerics, Japanese kana characters, and symbols.

- **Melody Generator**

The melody generator circuit has two section one is melody generation section and other one is a power amplifier. The UM66 integrated circuit and transistor together generate the melody and the IC LM380 and its allied component is designed to act as an power amplifier.

CALCULATION AND RESULT

Energy is the total power delivered or consumed over a time interval,

That is Energy = Power x Time

Power = voltage x current x power factor

The Energy Meter was tested in the Measurement Laboratories of Birsa Institute of Engineering &Technology, Sindri, Dhanbad. An Electric bulb of 220 volt was used as a load with 0.4A current. The supply voltage was between 210 V and 230 V. Energy measurement process is described step by step. Table 1 test result of Energy measurement by proposed prepaid Energy meter. Here power =60 watt

Table 1

Time (sec)	Expected Energy Meter Output (Watt-Sec)	Energy Output from Measurement
0	0	0
20	125	120
40	240	240
60	355	360
80	490	480
100	6000	6000
120	7100	7200
140	8500	8400

CONCLUSIONS

This proposed simple and economic digital prepaid energy meter controlled by GSM based communication can cover rural area as well as urban areas. This is an effort about improving the present conventional electromechanical meters through the fusion of analog and digital circuits which have aim of collecting bills for consumption of power thus improved the revenue collection for scheduled supply. This is beneficial for India like developing country which having huge population for improving economic through power utility.

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