

Prepaid Energy Meter With 8051 Microcontroller Using GSM

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Abstract

This paper presents the Prepaid Energy Meter with 8051 Microcontroller using GSM for prepaid billing of electricity used in house. Today in India, the present energy billing system is manual which increases processing time and becomes labor consuming. The manual billing system makes data reading and processing errors which may occur at every stage of energy billing. The aim of this system is to minimize the errors by introducing a new system of Prepaid Energy Metering using GSM. Also using this system, it reduces the queue at the electricity billing counters and to restrict the usage of electricity inevitably, if the bill is not paid. The GSM expertise is used so that the consumer would get messages about the consumption of power (in watts) and if it touches the minimum amount, it would automatically alert the consumer to recharge. The GSM module affords a mode of communication among the user and service provider. So, the user can recharge his/her electricity account from phone while sitting at home. The implementation of this system will help in better energy management, conservation of energy and automatic and authentic billing system. The automated billing system will keep track of the real time consumption.

Keywords: energy meter, GSM, microcontroller, prepaid billing system, SMS

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INTRODUCTION

This system works on prepaid energy meter which is utilized for sensing the energy automatically consumed at home. GSM SIM 300 is the interface in this system, which will make the interaction between the user and the energy meter.^[1] This paper describes an approach of transmitting the consumed electricity data and bill using GSM modem. Traditional meter reading is not fully efficient and more time consuming for meter readings and further processing to generate bills as well as the user has to pay bills in queue at the counter which is very much time consuming as well as inefficient.^[2] So, a system is required which collects meter readings automatically i.e. Automatic Meter Reading (AMR) systems. Its application lies in the household,

commercial and industries. In this proposed method, the consumption of energy will be monitored by the prepaid energy meter automatically.^[3] It records those readings continuously and transmits to the user through the GSM network. The GSM network sends a SMS (Short Messaging System) for electricity used and amount paid to the user.^[4] The service will be quick, fast and in a no time costumer will get the updated bill.

BACKGROUND

It is incompetent to have a collection of meter readings, because to take the readings, an onsite meter reader should be there. This method becomes more challenging and costly of collecting of meter readings when readings are collected from rural areas.^[5] This is due to

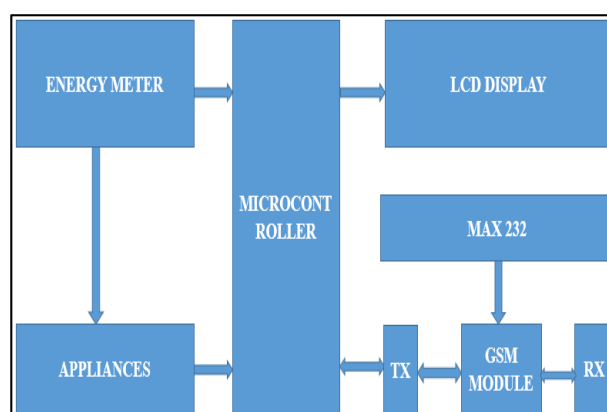
the fact that the meter readers not make efforts to travel such areas and in that they more than often submit the readings which were not according to the consumption of the electricity. In case of urban areas, plotting of traditional meter reading at the top of buildings, house plots are highly inefficient which leads to the customer's absence and missing bills, etc.^[6] For human survival and progress electrical power has become the need of this utmost hour. Apart from meeting growing upcoming demands, to enhance the life standard of people automation in the energy distribution is also necessary.^[7] How much energy you are using will be calculated by our SEM and will provide us.

The reading which will be send to us is accurate; regular information about your energy use. The systems consist of digital energy meter; a microcontroller and GSM modem.^[8] It has access to metering equipment and usage data and has real time data display. So, at power house the people who are there and the person who owns the equipment, whenever they want, they both can check the usage. The microcontroller IC AT89S51 was programmed according to energy meter.^[9]

BLOCK DIAGRAM OF THE SYSTEM

The Microcontroller AT89S51 here is acting as the primary controller. It collects information from the smart card and energy meter. The energy meter reading is taken by an IC MCT2E and from here it is send back to the microcontroller. Depending upon the result, the microcontroller will display the unit consumed and the amount to be given by the consumer on the LCD screen.

Using parallel port connection, the LCD is interfaced to microcontroller. The microcontroller based system, constantly registers the readings. The coding is done in such a way that human labor is reduced but the efficiency is increased in terms of calculating the electricity bill. So the user can be notified about the consumption of energy with the help of the GSM module. The major communication module between user and meter is the GSM modem which is serially connected with the controller. For transfer of the information the GSM implies on its own network. The messaging feature is the programmable output of the GSM AT commands.



Block Diagram of the System.

MAJOR COMPONENTS USED IN THE SYSTEM

Energy Meter

It is a device that measures the amount of the consumption of electric energy at households. Directly in-line between

source and customer these meters connect as a smaller service. Here, from energy meter, the unit is calculated which is consumed by the user using electrical appliances. For billing units, they are typically calibrated; the kilowatt hour is the most common amongst all which is equal to the amount of energy consumed by a load of 1 kWh over a period of one hour. Mega joule is the SI used by many electrical companies. These meters operate by measuring the instantaneous voltage and current continuously to give energy in unit of joules, kilowatt-hours, etc. The LCD is used to display the count and the impulse of the energy meter.^[10]

GSM Modem

“Electricity meter reading using GSM” implements the emerging applications of the GSM technology. GSM stands for Global system for mobile communication and is a wireless communications system in a wide area network which uses digital radio transmission to provide data, voice and multimedia communication services. GSM module is used for communication. In this project we have chosen SIM300. A standard 12V supply is required for the GSM modem. In every consumer unit there exists a GSM Digital Power Meters and a back-end database is present at the EB office which calculates according to the number of units consumed the amount to be paid by the consumer. This Power Meter is embedded with GSM modem and is a single phase digital kWh power meter which utilizes Short Messaging Service (SMS) for providing the amount of the electricity bill. This process is done wirelessly. A GSM system coordinates the communication between mobile telephones, base stations and switching systems. It provides us a feature of SMS through prepaid energy meter. The input is provided into the form of missed call to the number inserted into the GSM modem and it will respond with the electricity consumed by the appliances and will give

us the units and amount of the bill and display on the LCD screen.

LCD Display

To display the message, we are using 16*2 LCD display. ASCII value by the microcontroller is sent to the data bus of LCD to display any character on LCD. Alphanumeric LCD displays have become very popular because in a variety of ways they add a lot to the project. User instruction and feedback giving as a text message can make the application much more professional. The LCD has a total number of 14 pins with control pins and has 8-bit data interface. In a pair of two 4-bit nibbles or 8-bit one can send the data.

Microcontroller

In this system, the Intel 8051 family architecture is used where we are using an ATMEL AT89S51 microcontroller; it is called as ‘heart of our system’ and performs many more important operations between sender and the receiver and to control this function we are using AT commands of GSM in this. There is a ROM burner for burning the program into the microcontroller. It can erase or overwrite the program inserted into the microcontroller.

BASCOM-8051 SIMULATION

To implement this system, we require software for compilation and simulation. So, we are using BASCOM-8051 for this system. In this software, the code has been written which has been simulated and shows how the system will work when turned in the ON state whose images are shown below:

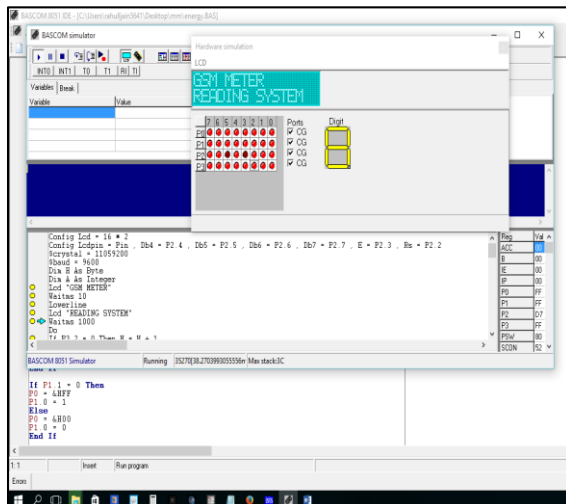


Fig. 1. Simulation of the Coding and Displaying of the GSM Meter Reading System.

In Figure 1 the compilation and simulation of the programming is done and the initial GSM meter reading is displayed on the LCD screen indicating the beginning of the cost of energy consumption.

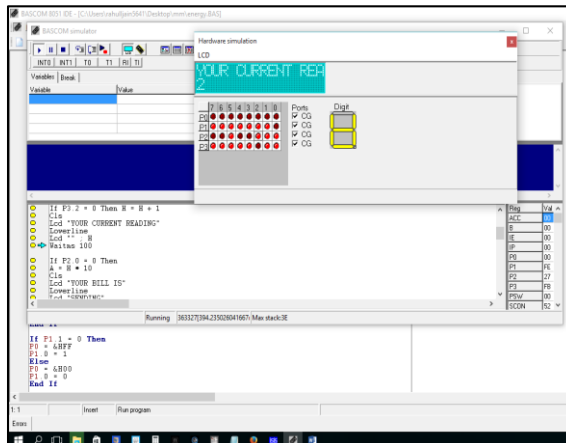


Fig. 2. Displaying of the Units Consumed by the Energy Meter.

In Figure 2, the electricity consumed by the appliances is displayed on the screen therefore according to which the amount required to be paid by the consumer can be calculated.

RESULT

This system will showcase the unit consumption and the billing amount of the electricity bill. This will help the users to

have a clear and accurate idea about their electricity consumption. This system works with the GSM modem and it works efficiently at every household and it can be used as well as in the industries. It will reduce the human labor and will increase the efficiency of the system which makes it more users friendly. It will enhance the slow systems at the electricity bill counters and moreover it will also help in energy management issues.^[11,12]

CONCLUSION

Before its consumption, Smart Energy meter using GSM technology can make the users to pay for the electricity. In this way, consumers can know about the consumption of their electricity. With the help of GSM communication an arrangement is made to intimate the required input provided for the starting of the process. The problem of affordability in utilities system can be solved using the SEM as a solution. The readings are continuously recorded because it is system designed in terms of microcontroller. SEM will produce an outcome of unnecessary wastage of power thus by creating awareness and will reduce the wastage of power. It can also be the solution of the theft protection mode in our daily life.

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