

GSM BASED ENERGY METERPriyanka Dighe¹; Tushar Dhanani²; Kumar Gangwani³; Dharmika Hegde⁴; Mrs Naveet Kant⁵

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Abstract : This paper presents a scheme to remotely monitor and control energy meter readings. It facilitates to read energy meters without having to visit each and every house/organizations. This system comprises a microcontroller which takes the readings at regular intervals and records it in its memory. This feature (remote monitoring) is made available as it consists of a GSM module which communicates the information regarding the meter reading via an SMS. The present meter reading system does not involve the GSM module. The scheme proposed and tested in this paper avails the GSM infrastructure, its nationwide coverage and the Short Messaging System (SMS) cell broadcasting feature to wirelessly transmit the individual house/organization power consumption readings. This system is greatly helpful to the Electricity Department as it enables them to take the meter readings on a regular basis.

Keywords: 89S51, SIM 300, AT commands..

Introduction

Energy distribution and consumption in a judicious manner are important requirements for a sustainable life. The present system of energy billing has many drawbacks such as excessive use of manpower, human errors, and inability of users to keep a track of their energy consumption and increase in the overall cost of this procedure. To overcome the existing drawbacks, a novel technique has been presented and tested to extract information about energy usage from a remote location. This paper suggests a GSM based system to collect, process and notify consumers about consumption. This system will be reliable, efficient and accurate to suit the requirements of the consumers. It will help in the minimization of technical errors and reduce human dependency at the same time. The electromechanical energy meters are being replaced by digital energy meters owing to their high reliability, accuracy and precision. Various features offered by AMRs are high speed, real time energy cost and improved load profile [1]. Some objectives of energy meters are:

1. Programming of remote modem with AT commands (A set of predefined instructions used with GSM/GPRS module to perform various tasks).
2. Interfacing controller with energy meter
3. Sending message from MODEM to a mobile phone.

Literature Survey

The existing systems consist of an electronic energy meter/electro-mechanical meter fixed in the premise for meas-

uring the consumption of electricity. The meters currently in use are only capable of recording kWh units. The kWh units used have to be recorded by meter readers regularly. The recorded data needs to be processed by a meter reading company. For processing the meter reading, company needs to firstly link each recorded power usage datum to an account holder and then determine the amount owed by means of the specific tariff in use. Many e-metering systems have been proposed based on GSM, GPRS, Bluetooth as explained in [2], [3], [4]. The GSM/GPRS enabled system is very convenient for sending data via SMS due to its good area coverage capability and cost effectiveness.

Methodology

The scheme uses the principle of serial communication of microcontrollers. The controller takes readings from the energy meter and sends it to the GSM module. A SIM card enabled GSM module is used to communicate to the end user. The scheme has the following components:

- GSM Module (SIM 300)
- Microcontroller (89s51)
- Single phase Energy meter
- Voltage regulator (5 V)
- LCD driver circuit
- LCD display

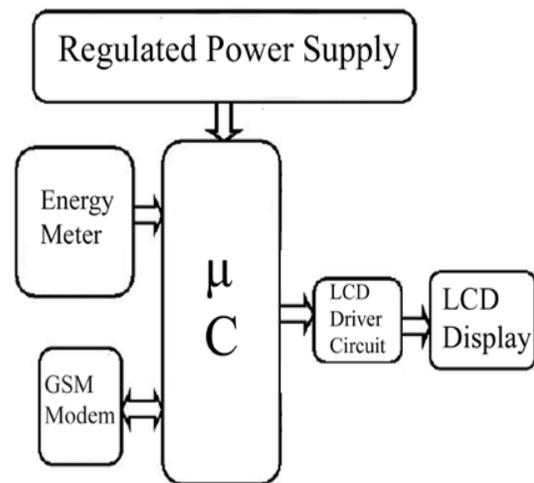


Figure 1. Block diagram [5]

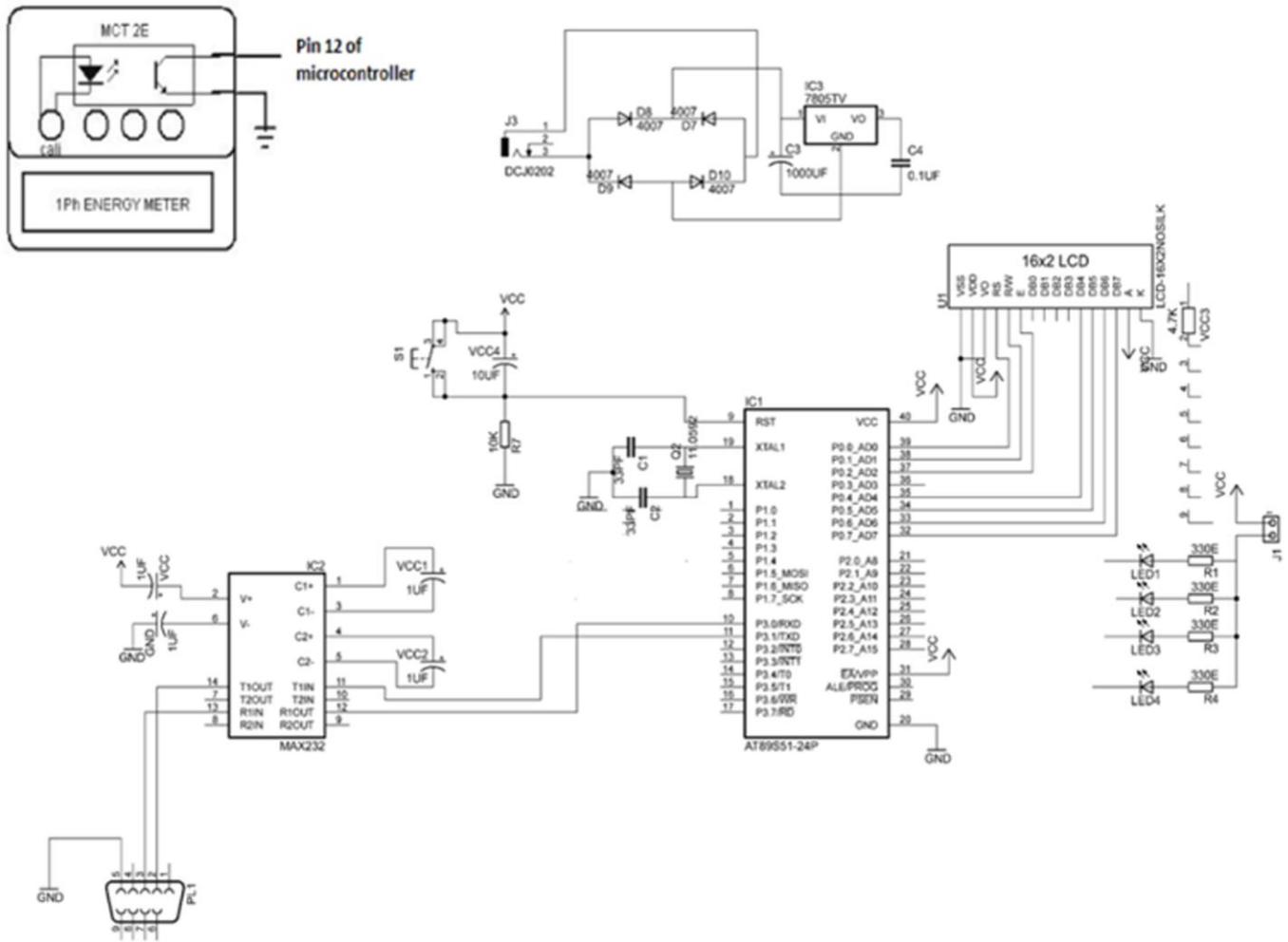


Figure 3. Circuit Diagram

Working

The digital energy meter records the amount of power consumption. It works on the basis of blinks of the LEDs located inside the meter. An optocoupler, which consists of an IR diode and a photo transistor, is used to detect the number of blinks by connecting it to an LED. Each time the LED blinks, current flows through the IR diode within the optocoupler. It then emits infrared light proportional to the current. This emitted light is incident on the base of the phototransistor, causing it to switch-ON and conduct in a way similar to a normal bipolar transistor. The pulses from the photo transistor are fed to the microcontroller as an interrupt to count the total consumption of the user. These readings are stored using an external memory, EEPROM. The digital meter used considers 3200 blinks of LED as one unit of power consumption per hour. In the scheme implemented, however, the microcontroller is programmed to treat 320 blinks as one unit per 6 minutes (1 hour=60 minutes/10). It

counts the consumption for 10 such cycles in one hour and then resets after every hour. LCD is connected to the microcontroller to display the current cycle of microcontroller. At the end of each cycle, the microcontroller calculates the billing amount using standard local rates and sends both the total consumption and the billing amount to the GSM module through an RS232 cable. GSM module is connected to the microcontroller via MAX 232 IC which converts the RS232 levels into TTL logic levels and vice versa. The GSM module is programmed using AT commands to wirelessly transmit the information received, to the user in the form of an SMS.



Figure 2. Snapshot of the implemented scheme

Applications and future scope

- The energy meter can be designed to have a unique identification number that will indicate the locality and consumer type as the billing system is different for different types of users. This number along with the consumed units of electricity can be sent with-out human intervention. The department can maintain a database to identify the type of location using this number and calculate the bill accordingly and send it to the user.
- For developing countries like India where a major chunk of the population lives below poverty line will become alert while consuming electricity if their bills reach them on a weekly or monthly basis as desired by them.
- If such bills reach more frequently, the users can become alert if there is theft of electricity by undesired sources or if the electrical appliances are left in working mode even when the users are not around.
- The system can be made smart by having a battery backup in case of power failure.
- Further reliability analysis can be done about the number of failures during the initial implementation, mature stage and the last stage.
- Effort can be made for the meters to remain robust so that the users do not have to replace their meters frequently. Also, these meters should be compatible with more than one remote monitoring system.

Conclusion

This scheme reduces human intervention required in keeping track of the total power consumption of the users. An SMS is sent directly to the user indicating the consumption and bill without the need of any individual from the Electricity Department to physically visit the site to note down the readings by the use of GSM module. This automation not only reduces the labor cost but also makes the system more efficient and accurate.

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