

# A smart prepaid energy meter for efficient power management

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**Abstract**—This work presents the design and modeling of an Energy Recharge System based on GSM for prepayment. Measurement. The current energy billing system in Bangladesh is error prone and also time and labor intensive. mistakes be introduced at each stage of energy billing such as errors with electromechanical meters, human errors, processing errors. The objective of the project is to minimize the error by introducing a new Prepaid Energy Metering system using GSM. The GSM module provides a mode of communication between the user and the provider. This will allow the user to recharge your electricity account from home. We can easily implement many plugins such as power demand, prediction, real-time dynamic rate based on demand and supply, etc.

**Index Terms**—Energy meter, GSM technology, Microcontroller AT89S52, Prepaid Card, Relay, Protius Software.

## I. PROJECT OVERVIEW

Smart (Prepaid) Energy Meter has been proposed as an innovative solution aimed at facilitating affordability and reducing the cost of utilities. This mechanism, essentially, requires the users to pay for the electricity before its consumption. In this way, consumers hold credit and then use the electricity until the credit is exhausted. If the available credit is exhausted then the electricity supply is cut-off by a relay. Readings made by human operators might have errors. This project addresses the above mentioned problems. The development of GSM infrastructure in past two decades made meter reading system wireless. The GSM infrastructure, which has national wide coverage, can be used to request and retrieve power consumption notification over individual houses and flats. Apart from making readings using GSM communication, billing system is needed to be made prepaid to avoid unnecessary usage of power. Those that support prepaid meters claim that they benefit both consumers and utilities because they help users to consume more efficiently and to improve the management of their budget, while allowing firms to reduce financial costs.

## II. COMPONENT LIST

- 1) GSM Communication Module
- 2) Arduino UNO
- 3) Resistor
- 4) Power Supply
- 5) LCD Display
- 6) Energy Meter
- 7) Relay

- 8) Key pad
- 9) LCD Display
- 10) CT Transformer
- 11) Potential Transformer

## III. IMPLEMENTATION

The proposed model has the PIC microcontroller as Central Processing Unit. The whole system is interfaced with PIC microcontroller. The GSM modem is serially connected with the controller which is the major communication module between User and provider. The GSM uses its own network for the transfer of information. Special coding in embedded c is used for programming PIC microcontroller using programmer Hardware along with MP-LAB IDE software. The relay acts as switching device to cut off and restore power supply. The LCD is interfaced to microcontroller using parallel port connection. In this project the Microcontroller based system continuously records the readings and the live meter reading can be sent to the Electricity department on request. This system also can be used to disconnect the power supply to the house in case of non-payment of electricity bills. A dedicated GSM modem with SIM card is required for each energy meter. The microcontroller pulls the SMS received by phone, decodes it, recognizes the Mobile no. and then switches on the relays attached to its port to control the appliances. After successful operation, controller sends back the acknowledgement to the user's mobile through SMS. The coding emphasizes the fact that it reduces human labour but increases the efficiency in calculation of bills for used electricity. The user will have an universal number and they can recharge outlets of electricity board. The acknowledgement of recharged coupon detail will come to notice of the consumer and also will get displayed in LCD module. So this process will bring a solution of creating awareness on unnecessary wastage of power and will tend to reduce wastage of power. This module will reduce the burden of energy providing by establishing the connection easily and no theft of power will take place. The LCD display will display the used amount and balance amount that can be used.

## IV. ALGORITHMS

The following steps of algorithm are given sequentially

- 1) Start the program.
- 2) Interface the LCD and the Keypad to the PIC Microcontroller.

- 3) Initializing the LCD.
- 4) Enter the card number.
- 5) Configure the GSM and send number to the service provider.
- 6) If the number is valid then receive the recharged amount from the service provider.
- 7) If the number is invalid then enter the correct number.
- 8) When the electricity is consumed, then the recharged amount will get decremented.
- 9) When 80 percent of the recharged is consumed, then the user will get a warning message to recharge the Energy Meter.
- 10) When the recharged money gets over, the relay cut-off the household power supply.
- 11) Stop the program.

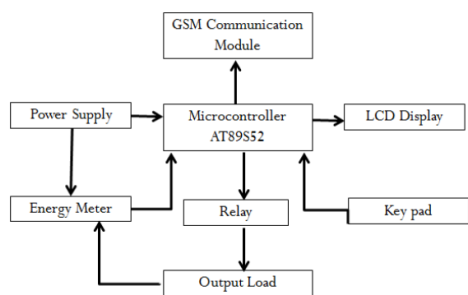


Fig.1. Block diagram of prepaid energy meter with gsm technology

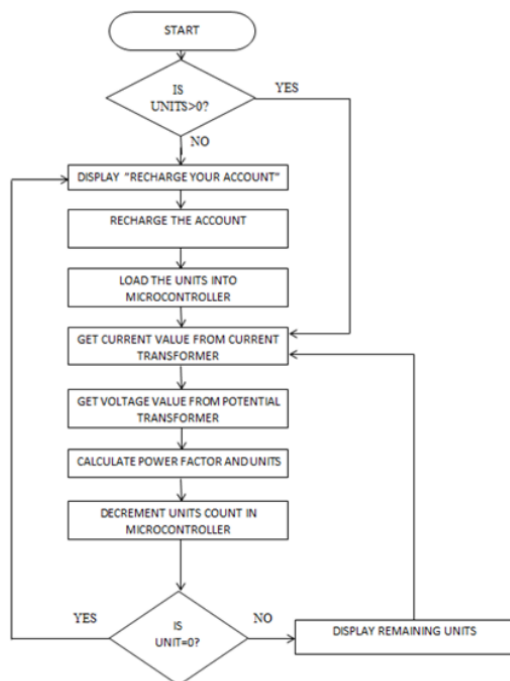


Fig.1. Flowchart for microcontroller programming

## V. CONCLUSION

The design of Smart Energy meter using GSM technology can make the users to pay for the electricity before its consumption. In this way, consumers hold credit and then use the electricity until the credit is exhausted. If the available credit is exhausted then the electricity supply is cut-off by a relay. This reduces human labour and at the same time increases the efficiency in calculation of bills for used electricity. Smart energy meters will bring a solution of creating awareness on unnecessary wastage of power and will tend to reduce wastage of power. This module will reduce the burden of energy providing by establishing the connection easily and no theft of power will take place. This paper work exposes the purpose of energy monitoring and controlling by implementing prepaid system. It is hoped that this work helps the consumers for better energy management and its utility in the distribution system for economic liability of the Electrical Boards.

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