GSM Based Automatic Energy Meter Billing system

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Abstract: This paper develops the design for automatic reading of electrical energy consumed in units using GSM technology. A LED of the digital energy meter is paired with the LDR whose output is connected to the microcontroller. Each blink of LED sends a signal to the microcontroller and microcontroller counts the number of blinks of the LED. The frequency of the blinking of led depend up on the connected load. The microcontroller updates the readings and display it over the LCD and saves in the EPROM. This recorded readings from the microcontroller is programmed to send the SMS after every one month of meter reading. Initially these details are updated in an electricity board and later the bill is sent back to the customer. For transmitting the data GSM module is used. The continuous monitoring and measuring of the energy meter is done by ARM controller. This intended system will be helpful for the electricity board for the accurate billing without any mish up and to reduce the manual manipulation.

Key words: Global system for mobile(GSM), digital energy meter, Advance RISC machine (ARM-LPC2148), Light Dependent Resistor (LDR), Liquid Crystal Diode (LCD).

I. INTRODUCTION

Now a days, Billing Spot Billers goes to every premise and takes the reading manually then issues the bill. In manually reading, human error maybe possible and will not provide reliable meter reading. An energy meter is a device which is used to measures the consumption of energy of any residence or other industrial establishment. In Conventional metering system to measure electricity consumption the electricity board hire a person who visit each house and record the meter reading manually. In Conventionally metering system, people try to manipulate meter reading by adopting various corrupt practices such as current reversal or partial earth fault condition, bypass meter, magnetic interference etc. If any consumer did not pay the bill, Operation and Maintenance staff needs to go to their houses to disconnect the power supply. The wide proliferation of wireless communication propose and explore new possibilities for the next generation Automatic Meter Reading (AMR) whose goal is to help collect the meter measurement automatically and possibly send commands to the meters. Automation ranges from Connecting to a meter through an RS-232 interface for transmitting the meter measurements all the way from the meter to the utility company via GSM network. We are using the digital energy meter in implies a times-sampled system.

Analog to digital converter sampled current and voltage transducers output at a high frequency, translating real world waveforms to binary words that digital circuitry can understand and manipulate. Digital energy meters maintain their accuracy over a larger current range than the mechanical meter. These new meters are also stable over change in temperature, voltage and line frequency.

1.1 Energy meter:

Watt hour meter or energy meter is an instrument which measures amount of electrical energy used by the consumers. Utilities install these instruments at every place like homes, industries, organizations to charge the electricity consumption by loads such as lights, fans and other appliances.
Most interesting type are used as prepaid electricity meters. Basic unit of power is watts. One thousand watts is one kilowatt. If we use one kilowatt in one hour, it is considered as one unit of energy consumed. These meters measure the instantaneous voltage and current, calculate its product and gives instantaneous power. This power is integrated over a period which gives the energy utilized over that time period. These may be single or three phase meters depending on the supply utilized by domestic or commercial installations. For small service measurements like domestic customers, these can be directly connected between line and load. But for larger loads, step down current transformers must be placed to isolate energy meters from higher currents.

1.2 EPROM:
An EPROM (rarely EROM), or erasable programmable read-only memory, is a type of memory chip that retains its data when its power supply is switched off. Computer memory that can retrieve stored data after a power supply has been turned off and back on is called non-volatile. It is an array of floating-gate transistors individually programmed by an electronic device that supplies higher voltages than those normally used in digital circuits. Once programmed, an EPROM can be erased by exposing it to strong ultraviolet light source (such as from a mercury-vapor light). EPROMs are easily recognizable by the transparent fused quartz window in the top of the package, through which the silicon chip is visible, and which permits exposure to ultraviolet light during erasing.

1.3 GSM modem:
A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages. GSM modems can be a quick and efficient way to get started with SMS, because a special subscription to an SMS service provider is not required. In most parts of the world, GSM modems are a cost effective solution for receiving SMS messages, because the sender is paying for the message delivery.

1.4 Liquid Crystal Display (LCD)
A 16 x 2 alphanumeric LCD is used which displays the number of units of energy consumed. To display the information on LCD, the microcontroller has to send its ASCII value to the data pins of the LC.

1.5 Block diagram
The block diagram of GSM based energy meter reading with load control is as shown below.

![Figure 1.Block Diagram](image-url)
II. WORKING

The energy meter records the amount of energy consumed by the load. In the olden days, electro-mechanical type of energy meters were available and now a days digital energy meters are available. The energy meter mainly works on the current increment in amount of current flow through circuit causes the disc to rotate, means that the rotational speed of disc is directly proportional to the amount of current flowing through circuit. Old type rotation effect of disc type meter causes the gear mechanism to work accordingly and in similar way power consumption by the load is recorded by the micro controller the blinking rate of LED integrated within the meter. Present type of energy meter also had a blinking led for the counting the pulses from this LED are fed to microcontroller for count operation i.e. these pulses are sent to the microcontroller and these readings are stored into external memory of the micro controller. External memory is an EEPROM.

This memory is able to store previous Energy consumed as well in case one needs to check present Energy consumed status. LCD is connected with microcontroller, microcontroller sends a message to LCD display unit so that we can view the status of GSM Modem. Whenever a message is sent to the GSM modem, it communicates the message to the micro controller and micro controller is responded back as the preset mobile number through the program. The due bill is sent by SMS to the customer after updating the readings in the electricity board and supply will be cut by the electricity department if the customer fails to pay the bills.

III. HARDWARE IMPLEMENTATION

In this system, power supply is provided to meter. A GSM unit shows the interfacing with the microcontroller. Transmission of usage details is send to office modem using user modem. Every consumer has unique number provided by corresponding authority.

The using of embedded system improves the stability of wireless data transmission. For a long distance transmission GSM telecommunication has shown excellent performance at any conditions.
3.1 Schematic diagram

![Schematic Diagram]

*Figure 2. Schematic Diagram*
3.2 Experimental Results

Figure 3. GSM Based Automatic Energy Meter Reading System

The corresponding results are shown below

Figure 4. Message Received By The Electricity Board

Your monthly units: 0017
Your monthly Bill: 0034

Figure 5. Message Received By The Customer

Dear customer,
Your monthly units are 17
Your monthly bill is 34.00 Rs
Meter number 002444
D.pratyusha
From now your bill should be paid within 15 days

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