© 2018 IJSRST | Volume 4 | Issue 8 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Automatic Meter Reading using Wireless Sensor Module

Mohd Zubairuddin[1], Pooja Thakre[2]

[1]Student, Electronics and Telecommunication Department, NUVA college of Engineering and Technology, Nagpur, Maharashtra, India

[2]Head, Electronics and Telecommunication Department, NUVA college of Engineering and Technology, Nagpur, Maharashtra, India

ABSTRACT

In the recent time huge advances have been made in the way the consumers are charged for the energy they consume. Things are moving out quite fast and areas where there was human intervention are being fast replaced by machines .The concept of e-metering (Electronic Metering) has been progressing at a very fast pace and with the ever increasing customer base the energy transmission companies are in need of a reliable and efficient Automatic Meter Reading (AMR) system. This paper presents a simple inexpensive GSM based Automatic Energy Meter Reading system (AEMR). The proposed system provides a remote access method for the consumer as well as the energy provider .It gives an opportunity to both the consumer as well as the supplier to remotely monitor the energy meters and thus helps in obtaining the energy reading in a hassle free manner .The Automatic Energy Meter Reading system (AEMR) regularly read the energy meter and calculate total amount of bill at the set dead line and sends the message to service provider. From energy meter received data i.e. user name, meter ID, total units with paying amount this message maintained at database server which located at service provider department. This system optimizes the time used in billing and provides a transparent interface to the consumer and the supplier to have an idea about energy consumed and the bill generated AEMR System can provide message at hourly, daily and monthly by the request , reduces the manpower required and prevent pilferage, improves the system efficiency thus turning out to be more efficient that conventional billing system.

Keywords : AMR, AEMR, Electronic Metering, TTL, WAMRS, GSM, ZIGBEE, GPRS, MAX-232, ARM7

I. INTRODUCTION

Now a day energy meter reader goes to every premise and takes the reading manually then issues the bill. In manually reading human error possible and 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 energy provider company hire persons who visit each house and record the meter reading manually. This is only a sluggish and laborious. 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, the electricity worker needs to go to their houses to disconnect the power supply.[1]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. [2] We are use the digital energy meter in implies a times-sampled system. An 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.

II. LITERATURE STUDY

O. Homa Kesav, B. Abdul Rahim in their work titled of "Automated wireless meter reading system for monitoring and controlling power consumption" have used the ARM7 LPC2148 microcontroller module which takes the data from the energy meter and performs the necessary control operations like breaking the circuit through Relay control unit and the required information to the mobile phone via the communication module GSM. The MAX-232 which was inbuilt in the ARM7 is used as a serial communication interface for the GSM modem for transmitting the data from the controller to the mobile phone. In the Load bank section a 60W incandescent bulb is used as a load for the purpose of energy consumption of the user.

E. Moni Silviya, K. Meena Vinodhini, Salai Thillai Thilagam. J.in their work titled "GSM Based Automatic Energy Meter System with Instant Billing"employ the IR sensor to mesure the current consumption. The IR transmitter is placed in the rotating unit of the EB meter. The receiver photo diode is placed in a certain place which is used to find no of rotation. By getting the number of rotation we get the current consumption. These system may be applied in Industrial control, medical system and access control.

Shraddha Male Pallavi Vethekar, Kavita More, Prof. V. K. Bhusari in their work "Smart Wireless Electronic Energy Meter Reading Using Embedded Technology" conclude that the metering IC creates the output in the form of pulses which are counted using the default timer of PIC microcontroller unit. These pulses are identified by the transition of high and low voltage of the automatic voltage regulator. A TTL inverter circuit is used to reverse the produced pulse before applying to the counter. For reading the data from the metering IC, microcontroller is programmed using software interfacing. When microcontroller reads the energy usage, this data is stored and updated in software. In this, meter is measured for 1 unit of energy consumption and it creates 3200 pulses in LED.

S. Arun, Dr. Sidappa Naidu in their work "Design and Implementation of Automatic Meter Reading System Using GSM, ZIGBEE through GPRS" present an implementation methodology for a wireless automatic meter reading system (WAMRS) incorporating the widely used GSM and Zigbee network. In many countries GSM and GPRS network is widely known for its vast coverage area, cost effectiveness and also for its competitive ever growing market. Using GSM as the medium for WAMRS provides a cost-effective, wireless, always-connected, two-way data link between utility company and WAMRS, the WAMRS sends information of utility usage, power quality and outage alarm to utility company, tampering detection to the utility servers. In this paper we suggest a method where we utilize telecommunication systems for automated transmission of data to facilitate bill generation at the server end and also to the customer via SMS, Email.

Ashna. k, Sudhish N. George in their work titled "GSM Based Automatic Energy Meter Reading System

with Instant Billing" use the two wire power supply which is connected to the energy metering IC through the analog front end of the MCP3905 energy meter evaluation board which provides average active power information via a pulse output which may be then used to be processed by a Micro Controller Unit (MCU). The GSM unit is interfaced to the micro controller via a MAX 232. User GSM modem transmits usage details to office modem. Every house/premise has a unique number (consumer number), which is given by the corresponding authority.

V. Rajesh Parvathala, T Venkateswara reddy, N V G Prasad in their work "ARM Based Wireless Energy Meter Reading System along with power on/off circuit" present a system which has 3 sections, Meter section, control unit section & mobile unit. The entire operation of the system is controlled by control unit with the help of switches. The switches the provide the option to read the energy meter, and to disconnect the services as and when needed.

On the basis of the research work carried out we conclude that there is a need of automatic GSM based energy meter system which eradicates the issue of manpower, power theft, human errors in recording the data and maintenance cost.

GSM METER – ARCHITECTURE

Whenever it is intended to develop a new technology the focus is to ensure that key issues are addressed properly and it is also necessary that the advanced features proposed address the problems of the previous technology and gets improved .Similarly there is need to upgrade the existing system and allow its use for everybody. The key is to develop a product that can serve as a replacement for the metering and billing system currently in use. This emphasis that the meter under development has to work under the old circumstances and perform all the previous functions, but also be able to relay the information in a new way and perform additional functions, without the need of replacing all meters on the electrical grid simultaneously.

The developed AEMR system consists of three main segments: an energy meter installed at the consumers place, transmission facility (SMS gateway), and the receiver which is a GSM mobile. The block diagram of the system is shown below Fig. 1 and Fig 2.

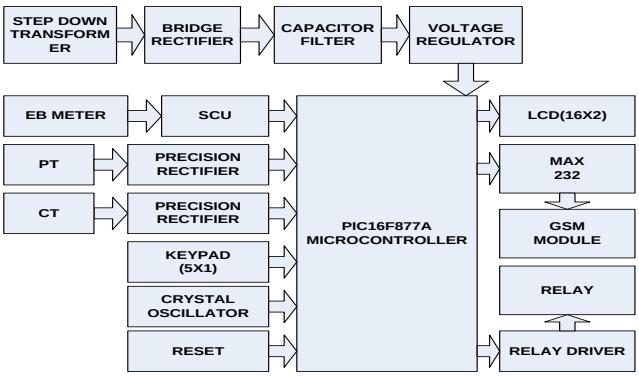

Figure 1 Block Diagram of Transmitter

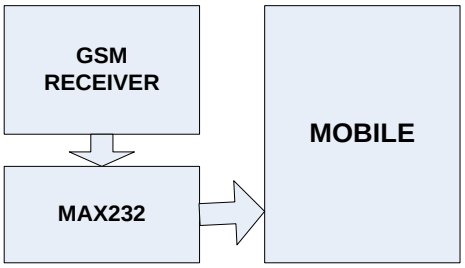

Figure 2 The receiver section with GSM Modem

III. DETAILED DESIGN

The main components of the project are PIC based microcontroller, 16×2 LCD, and GSM module. Here, we'll need to connect a crystal, a reset circuit to operate microcontroller. To use the external oscillator, a 4 MHz quartz crystal is connected to pins 13 (OSC1) and 14 (OSC2) of the microcontroller. Two 27pF ceramic capacitors are connected from the crystal to ground. The reset on the PIC microcontroller is active high i.e. upon applying a high pulse to RST pin, the microcontroller will reset. A 10KΩ resistor is connected from the RST of the microcontroller to ground. A 10µF electrolytic capacitor is connected between the positive supply and RST pin. The

External Access pin (Pin 11) is connected to positive supply using a 10KΩ resistor. This completes the basic connections with respect to microcontroller. Now we'll connect the LCD to microcontroller. To adjust the contrast of the display, a pot is connected to contrast adjust pin i.e. Pin 3 of LCD. First, connect the three control pins of the LCD i.e. RS, RW and E to RC4, GND and RC5. Then connect the 8 data pins of the LCD display to PORTD pins of the microcontroller. After connecting the display, now we are going to connect the GSM module. Connect the TX pin of GSM to RXD pin i.e. RC7 of the microcontroller. Similarly, connect the RX pin of GSM to TXD pin i.e. RC6 of the microcontroller. Output of precision rectifier is connected to RA0 and RA1 pin of microcontroller. Keypad is connected to RB0 – RB4 pin of microcontroller. Finally relay is connected to RB5 pin of microcontroller.

The aim of this project is to design an automatic meter reading using PIC microcontroller, in which meter reading will be send to power grid as well as customer along with bill amount. The working of the project is explained here. When this circuit is powered ON, initially the microcontroller will display the project name on the LCD display and shows meter reading. System will send message to power gride automatically after set duration and to the customer in a month along with bill amout. But if customer send "*1" message to the sim registered with gsm modem then microcontroller will send current reading along with bill amount to customer number. Along with meter reading our system will monitor voltage and current fault. Whenever over voltage is measure then microcontroller will switch off circuitry using relay similarly for under voltage and over current. Our system will operate on 5V dc power supply and to provide dc supply we have converted AC power to DC power using power supply unit.

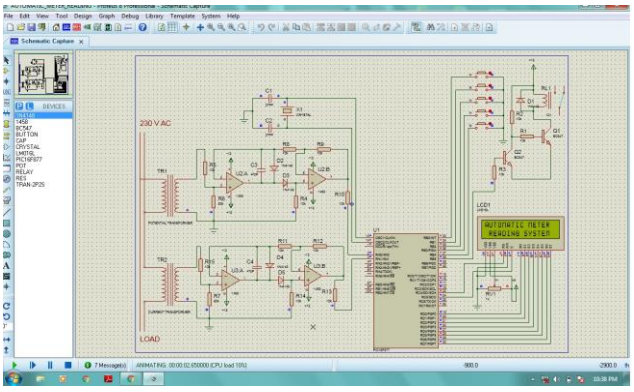

Figure 3: Proteus Simulation Circuit of Proposed System

Figure 4: Hardware Implementation of Proposed System

IV. CONCLUSION

Numerous of electronic meters have been proposed and presented and the GSM system proposed here provides numerous advantages over methods that have been previously used. Data transmission is charged at standard SMS rates, thus the charges are not based on the duration of data transmission. The cost efficient transmission of readings will ensure that power consumption values can be transmitted more frequently to a remote station. The implications of being able to transmit readings more often are that energy utilities will be able to generate timely bills, better understand energy demand patterns, manage meter failures more efficiently and manage fraud better.

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