

# GSM Based Automatic Energy Meter Reading System

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**Abstract:** This data presents the implementation of a simple low cost wireless Global System for Mobile (GSM) energy meter and imply the message back to the end user via GSM modem. A GSM occupying wireless communication module is synchronized with electronic energy meter of each entity to have far-off connection over the usage of electricity. This paper is useful to glean meter readings. The employed man power don't need regular visitation to each end user for the consumed data collection and to distribute the check slip. A phone with a GSM receiver at the other end, which contains the database acts as the billing sector. The complete monthly routine and due check is conveyed back after processing these data.

**Keywords—** GSM, Wireless, Energy meter.

## I. INTRODUCTION

Electrical power plays a vital role for the human survival and evolution. Apart from the efforts to meet rising interest, automation in the energy usage is also necessary to enhance people's livelihood. At this moment the employee goes to premises and draft the reading of the meter manually. An energy meter is a device which is used to measure the energy consumption of any residence or industrial establishment. In conventional energy metering system we measure consumption of energy. The company hire employees who visit each premises and draft the reading manually.

This is a sluggish and laborious work to be done. In skyscrapers and luxurious housing apartments and areas, traditional meter and the usage drafting process is outdated. There may be a chance for lacking checks, absence of consumer etc. Even though, these traditional meters cause problems they still persist. For a system which will provide the check in user's phone through the wireless GSM module will be more suitable to the current generation. The ample propagation of wireless communication gives out the new possibilities for the next generation Automatic Meter Reading (AMR) whose goal is to collect the energy usage from the meter automatically. AMR have new features that help to reduce the cost of usage to consumer and the man power provided by the utility provider is reduced. Here a new approach of electronic metering of energy meter is introduced in this script will automatically detect the energy usage and record these reading continuously, and then send it to the billing sector through the GSM module. Convincingly after processing the acquired data the check is generated and send to the end user as a message (SMS).

## II. LITERATURE SURVEY

[1] S. Arun, Dr. Sidappa Naidu "Design and implementation of Automatic meter Reading System using GSM, ZIGBEE through GPRS". This paper gives an implementation technology for a wireless automatic meter reading system incorporating widely used GSM and ZIGBEE. Using GSM WAMRS provides a cost-effective, wireless, the WAMRS sends information of utility usage, power quality and outage alarm to utility usage.

[2] B. Abdul Rahim, O. Homa Kesav "Automated wireless meter reading system for monitoring and controlling power. The ARM7LPC2148" microcontroller module gets the data from the energy meter and performs necessary operations like breaking the circuit through relay control unit and the information is send to mobile phone through GSM.

[3] Shradda Male, Pallavi Vethekar, kavitha More, Prof. V.K. Bhusari "Smart Wireless Electronic energy meter reading using embedded technology". In this Paper they presented that the metering IC gives the output in the form of pulses which are counted using the timer in PIC microcontroller. These pulses are identified by automatic voltage regulator. For reading the data from the IC, the microcontroller is programmed using software interfacing.

[4] E. Moni Silviya, K. Meena Vinodhini, Salai Thillai Thilagam.J "GSM based Automatic energy meter reading with instant billing". In This paper IR sensor is used to measure the current consumption unit. The IR transmitter is used in the rotating unit of the energy meter. By getting the number of rotation current consumption can be taken.

- [5] Ashna. K, Sudhish George “GSM based automatic energy meter reading system with instant billing”. In this paper MCP3905 energy meter evaluation board which gives average active power through pulse output. GSM is interfaced with microcontroller through max232.
- [6] P. Rakesh Malhotra, Dr. R. Seethalakshmi “Automatic meter reading and theft control system by using GSM”. In this paper GSM technology is used to transmit the meter reading to the customer and the required cost for the consumed power. IR sensor and magnetic reed switch is also used to control the energy theft.
- [7] Muhammad Rizwan Asgahar, Gyorgy Dan, Daniele Miorandi and Imeich Chlamtac “Smart meter Data Privacy”. In this paper smart meter are used to monitor the energy consumption of electricity consumers and also they added privacy settings for the data collected by the smart meters using Cybersecurity.
- [8] Young Joo and Dae-Hyun Choi “Optimal Household Appliance Scheduling Considering Consumers Electricity Bill Target”. This paper presents an algorithm that schedules the operation of the household to reduce the electricity consumption and thereby reducing the electricity bill. This algorithm provides targeted bill and enables the total electricity cost.
- [9] Sneha chaudhari, Purvang rathod, Ashfaque Shaikh, Darshan vora “Smart Energy Meter using Arduino and GSM”. In this paper electric energy meter is interfaced with Arduino to read the energy consumption of the consumers and it is interfaced with GSM which send the consumed power rate through message (SMS).
- [10] Syed Shahbaz Ali, Madiha Maroof, Sidrah Hanif “Smart energy meter for energy conservation and minimizing errors”. In this paper Smart energy meter is developed which improves the efficiency of the quality power by minimizing the energy cost by continuously monitoring the power quality.

### III. BUGS IN TRADITIONAL BILLING:

There are many bugs and errors in traditional billing. Some common mistakes and errors are:

- It's a time consuming procedure
- Extra human power is required.
- Consumer is not updated of his usage.
- Consumer may not get the check slip within due date.
- Illegal usage.

Some of the important issues are given above. This can be solve by automatic GSM based energy meter reading system.

### IV. DETAILED DESIGN:

This GSM based energy meter is fabricated using the 8-bit Microcontroller PIC 16F877A, Energy meter, a LCD display, GSM modem, RTC and an Opto-coupler. A single phase energy meter is designed with embedded

GSM modem which utilizes the existing GSM network to send its power usage value as SMS to the energy provider wirelessly. RTC module is integrated in the meter to have time to time recording of consumption. Block diagram of smart energy meter is given below figure 1.

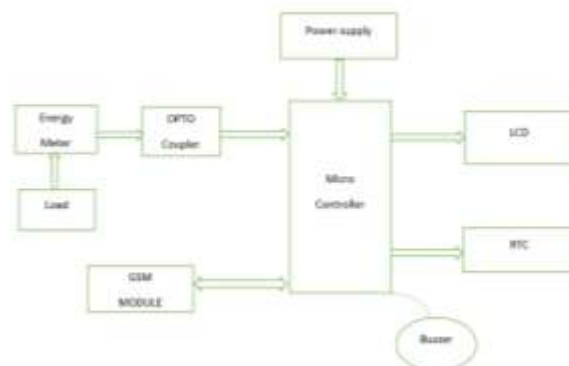


Fig 1. Block diagram of smart energy meter

### I. HARDWARE DETAILS:

The detailed circuit of the meter constructed by the components such as energy meter, microcontroller (PIC 16F877A), LCD (16\*2), GSM modem.

#### A. PIC Microcontroller:

PIC is a family of microcontrollers built by Microchip Technology. Early models of PIC had read only memory or EPROM for program storage, some provision for erasing memory but the current models uses flash memory for program storage. In our paper PIC 16F877A is used. There are 40 pins in this microcontroller IC. It consist of two 8 bit and one 16 bit timer. Capture and compare modules, serial ports, parallel ports and five input/output ports and also present in it. The input and the output ports are namely PORTA, PORTB, PORTC, PORTD, and PORTE which can be digital as well as analog. Microcontroller continuously monitors and records the energy meter reading in its permanent memory location. This system consists of a GSM modem which is used for remote monitoring and control of energy meter. The live readings are recorded simultaneously using the microcontroller. Meter readings can be sent to the electricity department on request. A dedicated GSM modem with sim card is required for each energy meter.

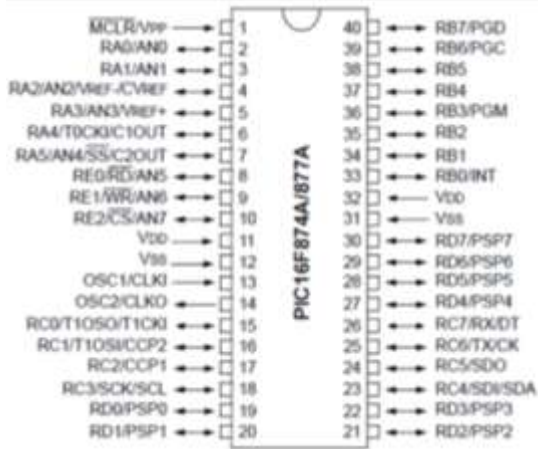


Fig 2. Pin configuration of PIC16F877A

#### B. GSM Modem:

GSM is a communication modem, stands for Global System for Mobile communication. A GSM Modem is a specialized type of modem which accepts SIM card which can be used to make a processor to communicate with the network. Quad band intelligent GSM modem is suitable for long duration data transmission. To implement Automatic meter reading system a GSM modem is connected to a microcontroller which would transmits data from a meter to cell phone and also receives command from cell phone to energy meter. The modem will send unit or pulses on a regular interval time.



Fig 3. GSM modem

#### C. LCD

LCD is an electronic display and has a wide range of application over various industries. In our paper 16x2 LCD display is used .It is a very basic module and it is widely used in various circuits. 16x2 LCD means it can display 16 characters in each line and it has only 2 lines. It is very economical and can be easily programmed. The Pin diagram for LCD is given below:

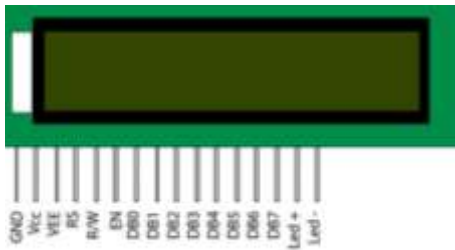


Fig 4. Pin diagram of opto-coupler

*D. Power supply:*

Voltage regulator IC7805 used to regulate output voltage to 5v. The microcontroller and other devices get power supply from dc adapter or from direct ac lines through voltage regulators.

*E. Opto coupler:*

It is used to transfer electrical signals between two components through light. In our paper MCT2E\_opto- coupler is used. It is 6 pin dual in line package. An opto-coupler consist of photo transistor and an LED in the same package. The pin diagram of opto-coupler is shown in the figure 5.

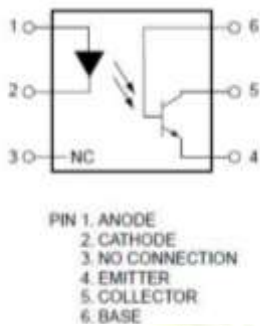


Fig 5. Pin diagram of opto-coupler

*F. Real time clock (RTC):*

RTC (Real Time Clock) is a computer clock which is always in track with the current timing. The common RTC used in computer is DS1307. This is used to maintain the real time and date in offline processing. RTC counts seconds, minutes, hours, and date of the month, month, and day of the week, year with leap-year.

*G. Relay circuit and buzzer:*

This relay circuit and the buzzer relay circuit turn gives an intimation about the maximum power consumed. Beyond certain limit the buzzer automatically makes a buzzing noise and the off the load for fraction of second and then load operates normally.

Fig 6 gives the detailed circuit diagram Smart Energy Meter.

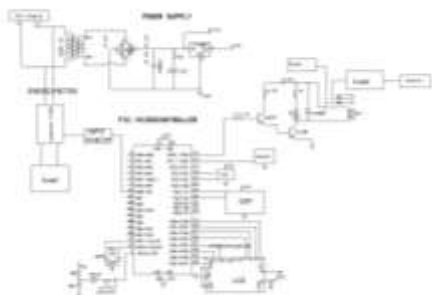


Fig 6. Detailed circuit diagram of Smart Energy Meter

**VI. SOFTWARE DETAILS:**

- Proteus 7
- MPLAB IDE v8.56
- PICKit 2

These are the software’s we used in our paper. All the coding required for pic is done in MPLAB IDE and it is compiled in Proteus 7. PICKit 2 is used for feeding the program into the PIC microcontroller. The algorithm for the meter can be modified at any time, even in the field. The transmitter prototype is given in Fig 7.



Fig. 7 Transmitter prototype

**ADVANTAGES:**

- This system is very accurate
- It is very simple
- Low power consumption
- This can be used for real time application
- Easy to manipulate bill generation

**APPLICATIONS**

- Electrical department
- Industry meter reading
- Household meter reading
- Railways

**VII. RESULT**

The designed smart meter is able to send the consumed energy to the consumers via SMS. The electricity consumption and the electricity bill is displayed in the LCD as show in the figure 8.



Fig.8 the results on display



## VIII. CONCLUSION

This paper describes the working of GSM based Automatic Energy Meter Reading System, removing errors from traditional current meter reading system. GSM being the exclusive feature enables quick messaging of the status of the energy meter. The opto-coupler senses the call-off LED that counts the number of the revolution in the energy meter. This count represents the energy consumed which is displayed in the LCD interfaced with PIC Microcontroller. Under this circumstance, GSM will send a prompt message to user periodically when the reference load is achieved. This idea will reduce man power to a great extent with exponential accuracy, eliminating human error. With easy implementation, generation of bill becomes very simple. When future waiting to bloom entirely with IOT, further extension will allow the consumer to know the consumption of energy instantly with data logger.

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