

Smart Energy Meter

K. V. Jyothi Prakash

Assistant Professor

Department of E&C Engineering

Siddaganga Institute of Technology, Tumakuru

Corresponding author's email id: jyothi.prakashkv@sit.ac.in

DOI: - <http://doi.org/10.5281/zenodo.3241780>

Abstract

Electricity has become one of the basic requirements for human life as it is being widely used for domestic, industrial and agricultural purposes [1]. Conserving energy is not just about saving up electricity costs, but also involves being eco-friendly, thereby, protecting the environment. Using a limited amount of electricity to fulfill one's needs is acceptable. However, it becomes a major issue when people start consuming excess electricity and start wasting it. Over the past years the consumption of electricity has increased massively, people may not notice the negative effects of high consumption of electricity at the moment, but it will have severe consequences later on. In this paper a smart energy meter is proposed with which the consumer will be notified the amount of power consumed by the end of the day such that he can plan the consumption of power. Also the power consumed by the consumer will be notified to the distributor as well as consumer such that no manpower is necessary for meter reading.

Keywords: *Smart power meter, Electricity, Consumer, Distributor, Microcontroller, GSM, WIFI*

INTRODUCTION

Electricity has become indispensable to human survival and progress. Apart from efforts to meet growing demand, automation in the energy distribution is

also necessary to enhance people's life standard. Meter reading by human operator is inefficient to meet the future residential development needs hence there is increased demand for Smart electronic

meter systems which collects meter readings without any human interventions. The electricity distributor has made rules in the billing system based upon the number of power units used where, the consumer will not be aware of his usage. Keeping this in consideration the smart energy meter will help in knowing the number of power units consumed and the amount that needs to be paid. If the usage is going beyond normal, consumer can control the operation of electric devices and can reduce the power consumption. The cost of power consumed will be calculated by reading the pulses generated by the meter. The calculated amount for a month is then sent to consumer and distributor and will also be displayed on the LCD to the consumer on daily basis. In existing system either an electronic energy meter or an electro-mechanical meter is fixed in the premise for measuring the usage which is capable of recording kWh units which is then have to be read by meter readers monthly. The cost for the recorded data will be generated according to the present tariff whereas; in smart electronic meter the meter reading need not be read. Both consumer and distributor will be sent the information which includes the details of their power consumption and the cost with time. Since the consumer already have prior

knowledge about their usage and the cost for the power consumed they can cut down their consumption of power and save it.

EXISTING SYSTEM

In the existing system, a mechanical or an electronic energy meter will be fitted at every consumer point which will record the amount of power consumed by the consumer. At the end of every month a meter reader has to visit every consumer and should issue the bill, hence lot of man power is required. In this existing system there is no any alert message given to the consumer about how much power they have consumed every day so that they can plan and effectively utilize the electric appliances and cut down the electricity bill. Only at the end of the month the consumer will come to know the electricity bill. Further in the existing system if any faulty electrical appliances are consuming more power than their rated power the consumer will come to know only at the end of the month.

PROPOSED SYSTEM

In the proposed system along with the mechanical or electronic energy meter optocoupler, Arduino UNO microcontroller, real time clock (RTC), liquid crystal display (LCD), WIFI module and GSM module will also be connected.

This smart energy meter will not only record the amount of power consumed by the consumer but also will send the alert message to the consumer through GSM about the amount of power consumed and the cost of the power consumed at regular intervals. Hence a smart consumer can plan the power consumption and can cut down the power consumption by properly using the electric appliances. Along with this since the WIFI module is connected, the bill generated at the end of every month can be sent to the distributor as well as a copy to the consumer such that the man power required for reading the meter for generating the bill can be avoided.

IMPLEMENTATION

A. Block diagram

The Block diagram of smart energy meter is shown in Fig. 1.

The smart energy meter consists of an electronic energy meter, optocoupler, Arduino UNO microcontroller, real time clock (RTC), liquid crystal display (LCD), WIFI module, GSM module and PC.

Energy Meter

An energy meter is a device which measures the amount of power consumed by the electrical appliances. Electric distributor uses energy meters which are installed at consumer's premises to record the power consumption for billing purposes, the calibration LED present in the energy meter will indicate the real time power consumption by the consumer and by recording the number of blinking of the LED the power consumption is calculated.

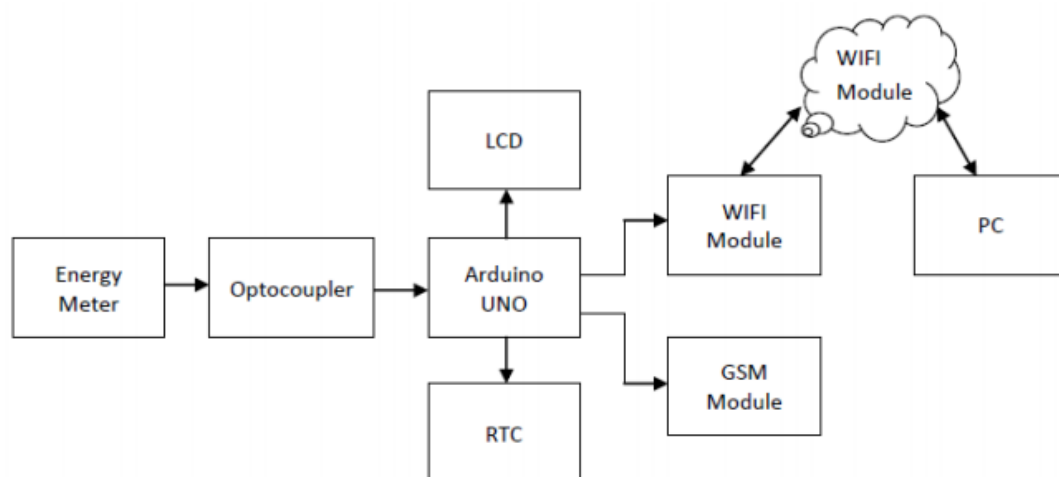


Fig. 1 Block Diagram of Smart Energy Meter

Real Time Clock (RTC)

The RTC is used to keep track of date and time to generate bill at regular intervals, it is interfaced to Arduino to initiate the GSM and WIFI module for sending information to consumer and distributor.

Arduino UNO

Arduino UNO is a microcontroller used to interface optocoupler, LCD, RTC, WIFI module and GSM module. Arduino will count the pulses given by optocoupler which is the real time power consumption by the consumer and calculate the cost for the power consumed.

The power consumed and the cost will be displayed on the LCD and at regular interval initiated by RTC the details will be sent to consumer through GSM and to the distributor using WIFI module.

Liquid Crystal Display (LCD)

A 16×2 LCD is used to display the power consumed by the consumer and cost of the power consumed at the user end.

Global system for mobile communication (GSM): GSM is used to send the calculated power consumed and the cost to the consumer through SMS.

WIFI Module

WIFI is used to connect the PC at the distributor end to the consumer point. The power consumed and the cost will be updated in the PC at the distributor end using WIFI.

B. Design

For every 1 Unit (1KWh) of power consumption the calibration LED in the energy meter will blink 3200 times which will be converted as 3200 pulses by optocoupler. These pulses will be counted by the Arduino and calculate the power as per the current tariff. At regular interval the RTC will initiate the process to send the details power consumption and the cost to the consumer and distributor.

C. Methodology

The methodology of implementation of smart energy meter is shown in Fig. 2.

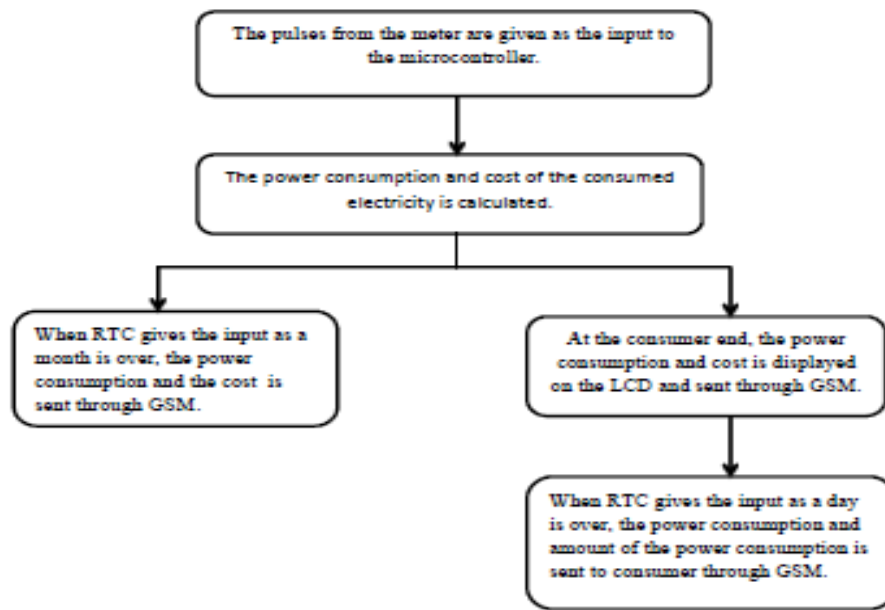


Fig. 2 Methodology of implementation of smart energy meter

D. Flowchart

The flowchart of smart energy meter is shown in Fig. 3.

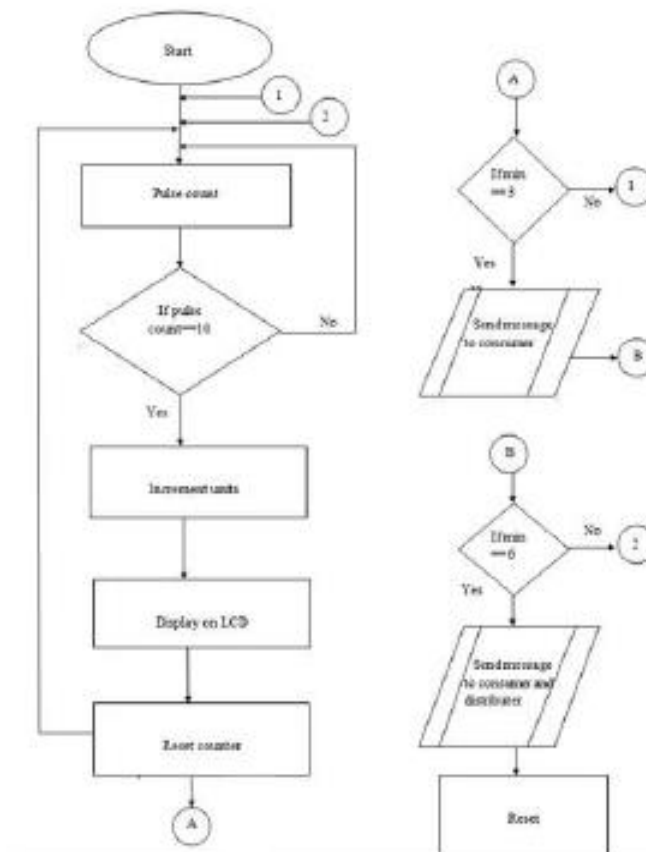


Fig. 3 Flowchart of smart energy meter

RESULTS AND CONCLUSION

A. Results

The working model of the smart energy meter is shown in Fig. 4.

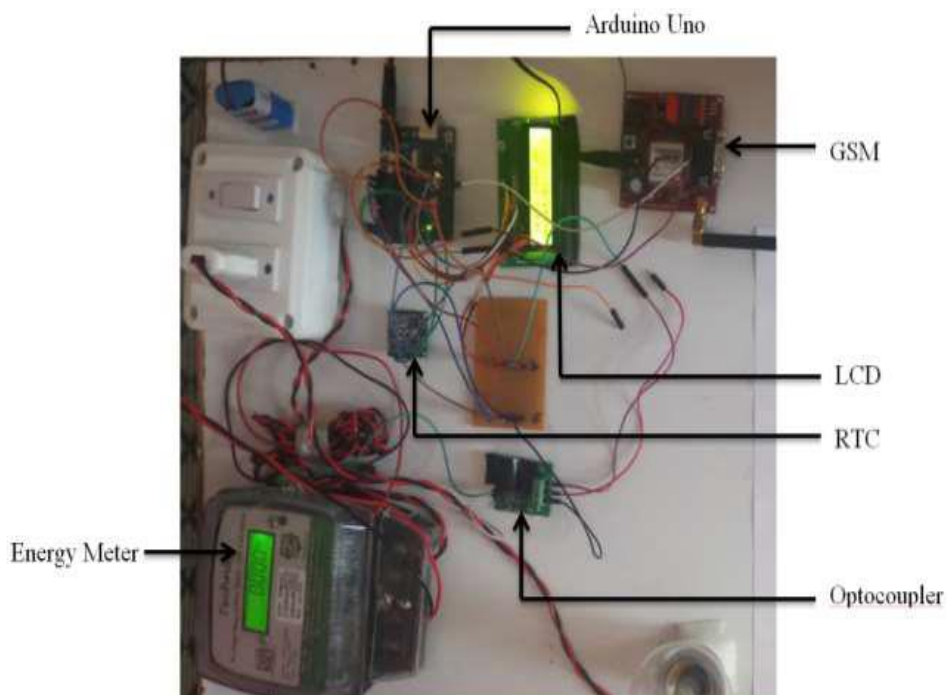


Fig. 4 Working model of smart energy meter

The display of power consumed and the amount for the power consumed on LCD is shown in Fig. 5.



Fig. 5 Display of power consumed and the amount for the power consumed on LCD

The message sent to the consumer about the power consumed and the cost of the power consumed is shown in Fig. 6.

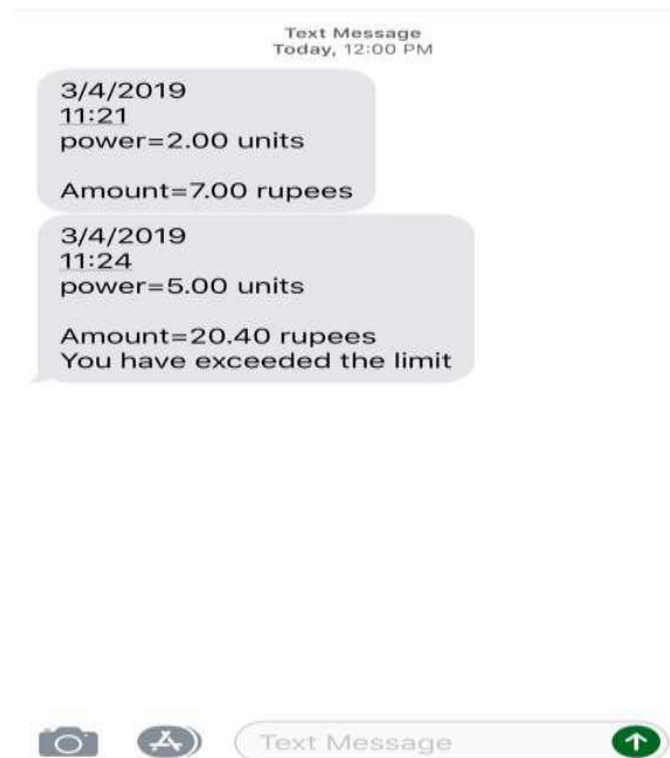


Figure: - 6 Message sent to the consumer about the power consumed and the cost of the power consumed

CONCLUSION

The Smart Electronic Meter is successfully designed, which sends the message of power consumption along with cost to both consumer and distributor using GSM at the end of each month. It also sends the alert message to consumer about the amount of power consumed and the cost for the power consumed at regular interval of time. The automation of billing system eliminates the human involvement hence it is more reliable. Smart Energy Meter will bring the solution of creating awareness of unnecessary usage of power and will tend to reduce the wastage of power.

REFERENCES

- I. Bharath P, Ananth N, Vijetha S, Jyothi Prakash K.V, "Wireless automated digital Energy Meter", International Conference of E-Society, E-Education and E-Technology (ICSET), 2008.
- II. Win Adiyansyah Indra, Fatimah Bt Morad, Norfadzlia Binti Mohd Yusof, Siti Asma Che Aziz, "GSM Based smart Energy meter with Arduino", International Journal of

Applied Engineering Research,
Malaysia, 2015.

- III. Sneha Chaudhari, Purvang Rathod, Ashfaque Shaikh, Darshan Vora, Jignesha Ahir, “Smart energy meter using Arduino and GSM”, International conference on Trends in Electronics and Informatics (ICEI), 2017.

- IV. S. Vougioukas, M. Roumeliotis, “A system for basic-level network

fault management based on the GSM short message service (SMS)”, International Conference on Trends in Communications, 2001.

Cite this Article As

K. V. Jyothi Prakash (2019). **Smart Energy Meter**, Journal of Embedded Systems & Its Applications, 4(1), 32-39

<http://doi.org/10.5281/zenodo.3241780>