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DESIGN AND IMPLEMENTATION OF PREPAID ENERGY METER AND DATA ACQUISITION SYSTEM

N Anusha[1], A Suman Kumar Reddy[2]

[1]M Tech Scholar, Dept. of ECE, PBR Visvodaya Institute of Technology & Sciences Kavali, SPSR Nellore(Dt.), Andhra Pradesh
[2]Associate Professor, Dept. of ECE, PBR Visvodaya Institute of Technology & Sciences Kavali, SPSR Nellore (Dt.), Andhra Pradesh

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Abstract - *Generally the households have postpaid electricity connections. Because of this postpaid connections consumer faces many problems, such as that the consumption of electricity is not traced by the consumers and many times they are shocked, when they receive high bills. This project is aimed to design a prepaid electricity recharge circuit that would work as electricity recharge unit which integrate with the regular household energy meters and capable of counting down energy usage and cut off the main supply once the energy usage countdown reaches zero and an additional circuit is designed that acts as data acquisition system . A Data Acquisition System is used to store the recharge information from the recharge station and could be plugged to the circuit integrated to energy meters for regulating main supplies.*

Key Words: **Data Acquisition System (DAS), Prepaid Electricity Recharge (PER) and Global System for Mobile Communications (GSM).**

1. INTRODUCTION

The consumer faces many problems from the post-paid connections. Prepaid electricity connections are usually suggested as the practicable solution to this problem. In this prepaid electricity meter circuit, consumer would need to recharge the amount of electricity they need to consume. In this system, the household electricity meters need to be equipped with a system that could be acknowledged of the amount recharged by the consumer and could count down the electricity consumption from the amount recharged to zero. Once the meter count reaches zero, the main supply would be automatically cut off and could be resumed only after the next recharge.

We are building this system using Arduino and GSM module. We can recharge electricity balance from online portal. The power supply connection to home is automatically disconnected if balance is low or zero. This system is also designed to send energy consumption updates of meter to substation in regular intervals using zigbee module simultaneously it will alert consumer with low balance, cut off, resume and recharge through SMS.

2. RELATED WORK

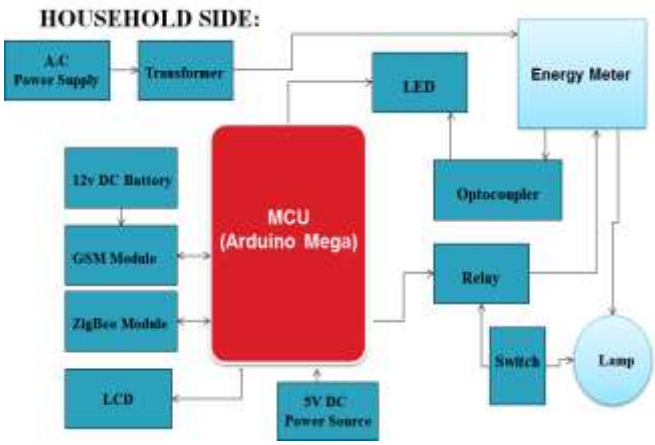

Fig. 1 Block diagram for House hold side

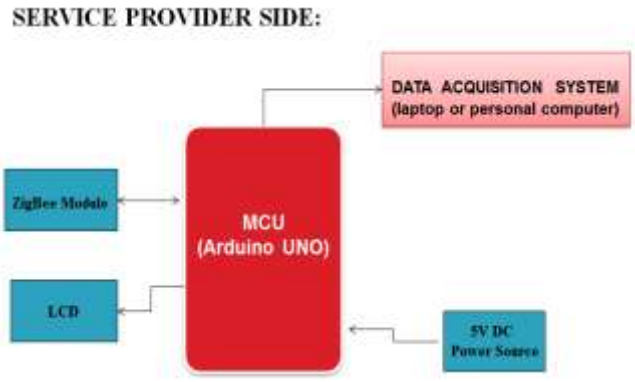

Fig. 2 Block diagram for Service provider side

Components used:

- Arduino
- GSM Module
- 16x2 LCD
- Analogue Electricity Energy Meter
- Optocoupler 4N35
- Resistors

- Connecting wires
- Relay
- ZigBee module
- Bulb and holder
- SIM card
- Power supply

Working procedure:

In our project there is a prepaid energy meter, When this mode is active relay 1 is used to cut off or continue the power supply. EEPROM1 stores amount of energy remaining. When this count reaches near to zero "balance is low" SMS is send to that particular user. If the user fills the balance then uninterrupted power supply is provided. If the user do not fills balance then when counter reaches to zero with the help of relay1 power supply to the user is switched off. The energy meter generates pulses to the microcontroller for every unit of energy consumed. Then microcontroller increments the spent energy unit by one and decreases the balance amount in the EEPROM by the fixed tariff. If the balance amount in the EEPROM becomes zero, the microcontroller automatically turns off the relay, such that the main supply to the load is switched off, simultaneously SMS alert is sent to consumer indicating low balance. The consumer can recharge by logging into the recharge portal provided by the service provider, after successful recharge the microcontroller connects the supply to the load simultaneously SMS alert is sent to the consumer indicating reconnection status. The energy meter gives electric signal to the opto isolator which consists of an LED and an opto-transistor combination such that the LED glows and emits light for every electric signal received by the energy meter. The opto-transistor starts conducting and sends high and low pulses to the microcontroller. The microcontroller is programmed such that a counter is kept incrementing for every pulse rate, which gives the value of the energy consumed.

Calculation of Pulses and Units:

Before going for calculations, wehave to know the pulse frequency of energy meter.

There are two rates first is 1600 imp/kwh and the second is 3200 imp/kwh. Here we use 3200 imp/kwh pulse rate energy meter. First we need to calculate the Pulses for 100watt,i.e. the count that Pulse LED will blink in a minute, for the load of 100 watts.

Pulse= (Pluse_rate*watt*time)/ (1000*3600)

So pulsesbulb in 60 seconds for 100 watt, with energy meter of 3200 imp/kwh rate can be calculated as below:

Pulses=3200*100*60/1000*3600

Pulses = ~5.33 pulse per minute

Now we have to calculate the Power factor of single pulse, i.e how much electricity will be consumed in one pulse:

Power Factor= watt/(hour*Pulse)

Power Factor=100/60*5.33=0.3125 watt for single pulse

Units= Power Factor*Total pulse/1000

Total pulses in an hour is around 5.33*60=320, SoUnits = 0.3125*320/1000 = 0.1 per hour

Let us assume that 100 watt bulb is lighting for a day then it will consume

No of Units =0.1*24 = 2.4 Units

And suppose unit rate is at our region is 5 rupees per unit then we have to pay for 2.4 Units Rs:Rupees= 2.4*5 = 12 rupees

3. RESULTS

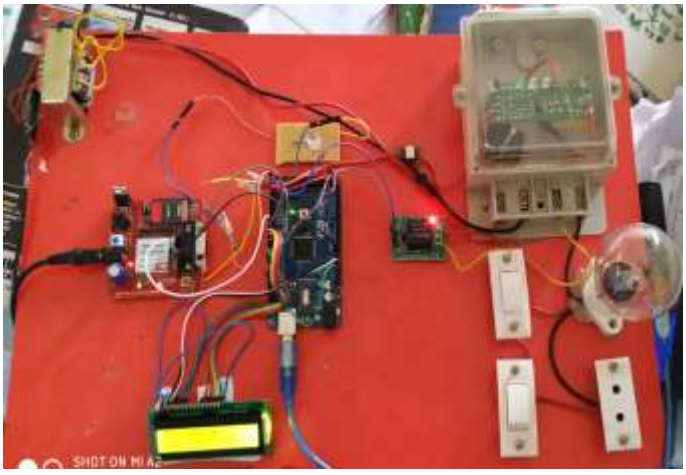

Fig. 3 Figure showing Prepaid Energy Meter System

Fig. 4 Graphical user interface used by the consumer to recharge meter

Fig. 5 Figure showing prepaid energy meter recharge status SMS alert

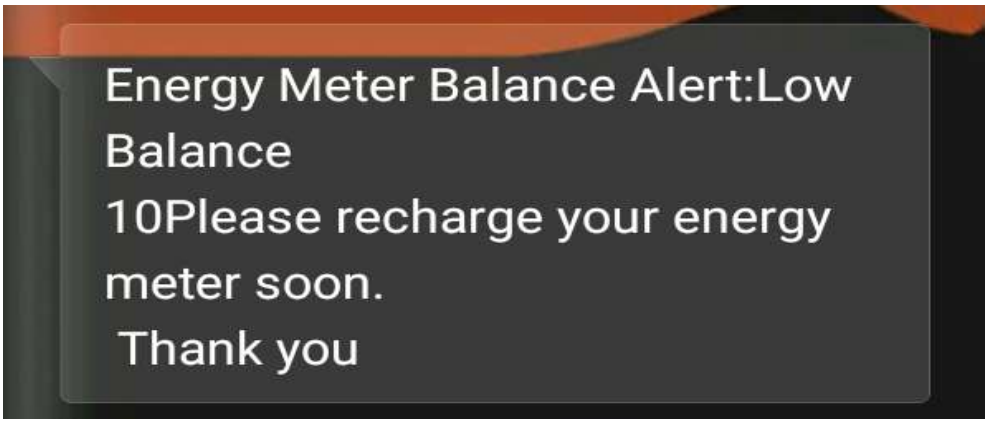

Fig. 6 Figure showing prepaid energy meter low balance SMS alert

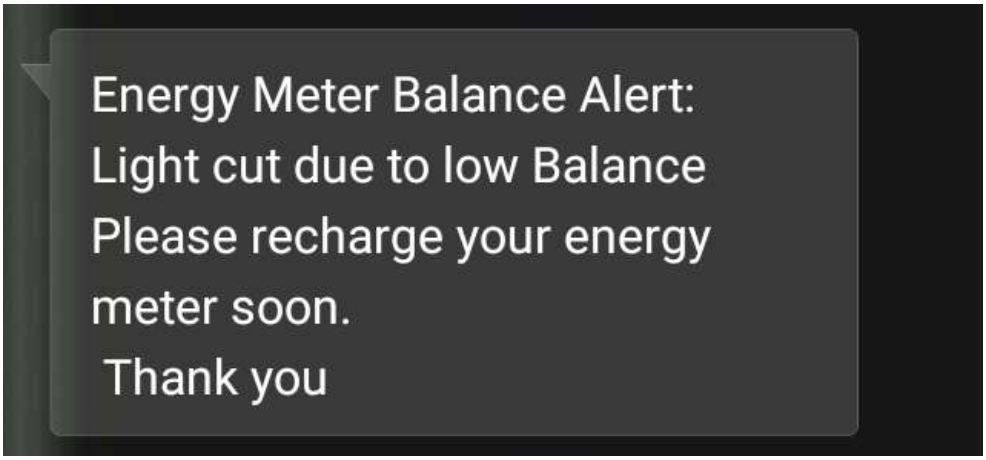

Fig. 7 Figure showing prepaid energy meter connection cut SMS alert

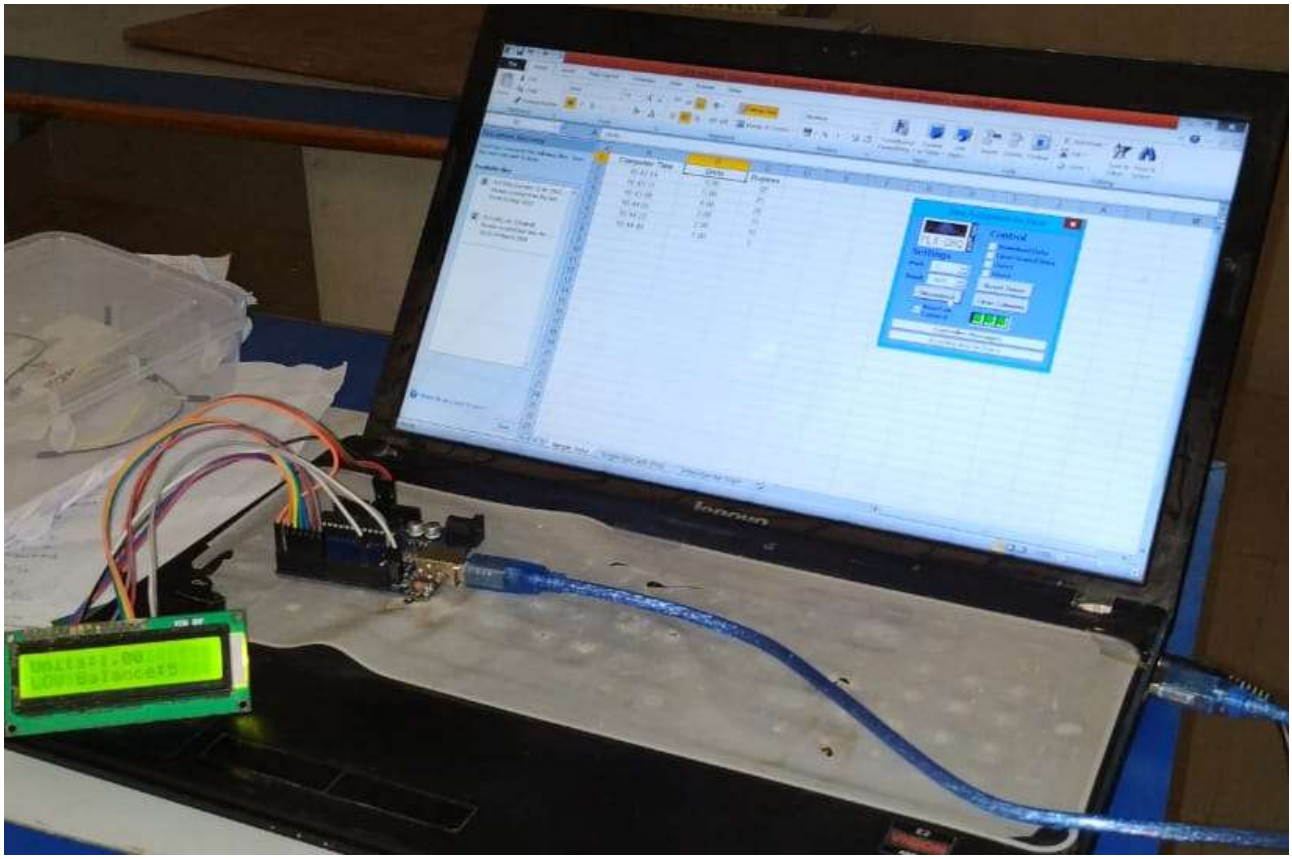

Fig. 8 Figure showing Data Acquisition System (DAS)

4. CONCLUSIONS

The system was able to transfer and query energy units in real time without the help of any human interactions, thus easing the monitoring process. In the system proposes to integrate other features like sending reminders based on rate of energy units used. In addition computing energy units based on tariff rate, top up amount and taking into amount of energy used towards energy conservation. Last but not least adding the energy units to energy meter from energy department based on top up from user.

REFERENCES

[1] Md.Manirul Islam, Mohiuddin Ahmed, Md. Ajijul Islam, Abu FarzanMitul, M.F. Malek, and M.A Rashid, "Electronic Energy Meter with Remote Monitoring and Billing System."2012 7th International Conference on Electrical and Computer Engineering 20-22 December 2012, Dhaka, Bangladesh.

[2] Shi-Wei Lee, Cheng_Shong Wu, Meng-Shi Chiou, Kou-Tan Wu, "Design of Automatic Meter Reading System."

[3] Shi Jiong Yuan; "Remote wireless automatic meter reading system based on GPRS," Communication Software and Networks (ICCSN), 2011 IEEE 3rd International Conference on, vol., no., pp.667-669, 27-29 May 2011.

[4] Abdollahi, A. Dehghani, M. Zamanzadeh, N., "SMS-based Reconfigurable Automatic Meter Reading System," IEEE International Conference on Control Applications (CCA 2007), pp. 1103 – 1107, Oct 2007.

[5] S.Arun, Dr, Sidappa Naidu," Hybrid Automatic Meter Reading System,"International Journal of Advanced Research in Computer Science and Software Engineering,Volume 2, Issue 7, July 2012 ISSN: 2277 128X.

[6] Alauddin Al-Omary, Wael El-Medany, Sufyan Al-Irhayim" Secure Low-Cost AMR System Based on GPRS Technology,"International Journal of Computer Theory and Engineering, Vol. 4, No. 1, February 2012.