

GSM based Automatic Meter Reading and Billing System

¹Sachin Bhat, ²Kaushal B Shetty, ³Reshma Jasmine D'souza, ⁴Swathi Shetty, ⁵Rajesh S R

Department of ECE
SMVITM, Udupi, India

Abstract—Owing to high electricity cost these days it becomes necessary for the consumer to know as to how much electricity is consumed to control electricity bill within his budget. In this proposed system, the consumer will get his energy consumption data on real time basis on a LCD display. The same data is sent through GSM modem to the electricity department via SMS. Arduino is interfaced to the energy meter to get the Watt Hour pulses. The Arduino then processes these pulses according to the program written in it, to calculate the units consumed and cost involved. Further it gives command to the SIM loaded GSM modem for sending the data to the customer/consumer via SMS. Further this work can be enhanced to control the electrical appliances remotely via SMS. Also it can be used to monitor the power consumption or any other factor like pressure, temperature etc. with appropriate changes.

IndexTerms—Arduino, GSM, Automatic meter reading (AMR)

I. INTRODUCTION (HEADING 1)

Electrical power 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. Traditional meter reading by human operator is inefficient to meet the future residential development needs. So there is increased demand for Automatic Meter Reading (AMR) systems which collect meter readings electronically, and its application is expanding over industrial, commercial and utility environment.

This traditional energy meter billing techniques require huge number of labor and also long working hours to gather complete data and billing. Sometimes the energy meter is placed in a location where it is not easily accessible, also this data collection may not be completed in first visit and the meter reading staff have to revisit. Manual billing is sometimes restricted and it is slowed down by weather condition or various another reasons. Printed billing has inclination towards losing in the mailbox. In this project, a new method of post-paid electronic energy metering is introduced in this paper which will automatically sense the used energy, records these reading continuously, then sends it to the billing point through the wifi module. Finally, after processing the collected data bill is generated using a web based system software and is send back to the customer as SMS (Short Messaging System) using GSM network. As it is web oriented once the data is updated, the registered users and authority can monitor and analyze the generated bill of any month by sitting anywhere in the world.

II. LITERATURE SURVEY

For communication to the server many options are available as wired or wireless such as, power lines, cable networks, RF modules, GSM modules, Zigbee, which are studied by different researchers. Abhinandan Jain et al. [2] represented the development of a fully Automated Energy Meter which has capacities such as remote monitoring and energy meter controlling. Here Automatic Meter Reading system (AMR) continuously monitors the energy meter and sends data on request of service provider through SMS. That system was allowed to the customers to pay online bill either by credit card, debit card or by net banking.

In paper [3] (2007) H. G. Rodney Tan et al. introduced working prototype of GAPMR system which is built to demonstrate the effectiveness and efficiency of automatic meter reading, billing and notification through GSM network as a message. Ashna K, Sudhish N Gorgre a proposed system [4] which automatically reads the energy utilized and sends it to the service provider with the use of the existing short messaging services (SMS).

Power lines [5] are readily available and making the full use of them is most desirable for the energy suppliers. These papers presented an investigation of the LV power line characteristics in the A Band of European Committee for Electromechanical Standardization European Norm (EN) 50065-1 standard for implementation of automated meter reading in dense residential areas.

A. Ali et al. presented AMR using radio frequency technologies [6], [7] is wireless electric power management and control system. The secure mobile agent concept was presented in [8] which energy meters can be organized in a group based upon the geographical location. In one location energy meters perform their jobs under a security manager. The concept of local mobile agent is proposed to avoid the visit of external mobile agent to energy meters directly. Embedded energy meter [9] where maximum demand of energy of a consumer will be indicated in the meter used by the consumer. After exceeding the maximum demand, the meter and hence the connection will automatically be disconnected by an embedded system inserted in the meter itself.

III. METHODOLOGY

Step 1: The WiFi module is initialised.

Step 2: The value of the energy meter is read through optocoupler by sensing the pulses generated by it.

Step 3: Arduino receives the pulses and calculates the unit.

1 unit=1kWh=3200 pulses.

Step 4: The Data is sent to the database through WiFi module. Also SMS containing the units consumed is sent to the service provider.

Step 5: On a particular date of every month the bill is generated. A SMS is sent to the customer giving the billing information. Also a dedicated android application shows the billing details.

The prime aim of the project is to make a automated system for energy meter billing that reduces the need for human intervention to almost zero. The meter reading is read by a arduino which in turn sends the data to the database where the bill is calculated. The bill information is reverted back to the customer through a dedicated app as notification. The customer can have a detailed look of the history as well in the app. Also, since all customers aren't connected with internet and smart phones, a GSM module is used which sends the information of the bill via SMS. The arduino has the required code for calculating the bill. The energy meter generates electricity pulses corresponding to the electricity used. An optocoupler (MCT-2E) is used to read these pulses. This goes to the arduino board which sends this data to the database using ESP 8266-01. The database is a apache My SQL server. It stores the data sent by Arduino. The unit used for a a billing period is calculated and sent to the customer through the android app. For customers with no internet or smartphone, the GSM system sends a SMS with the bill details as units consumed and the bill for that much units of electricity. The bill is calculated on the Arduino based on the predefined code.

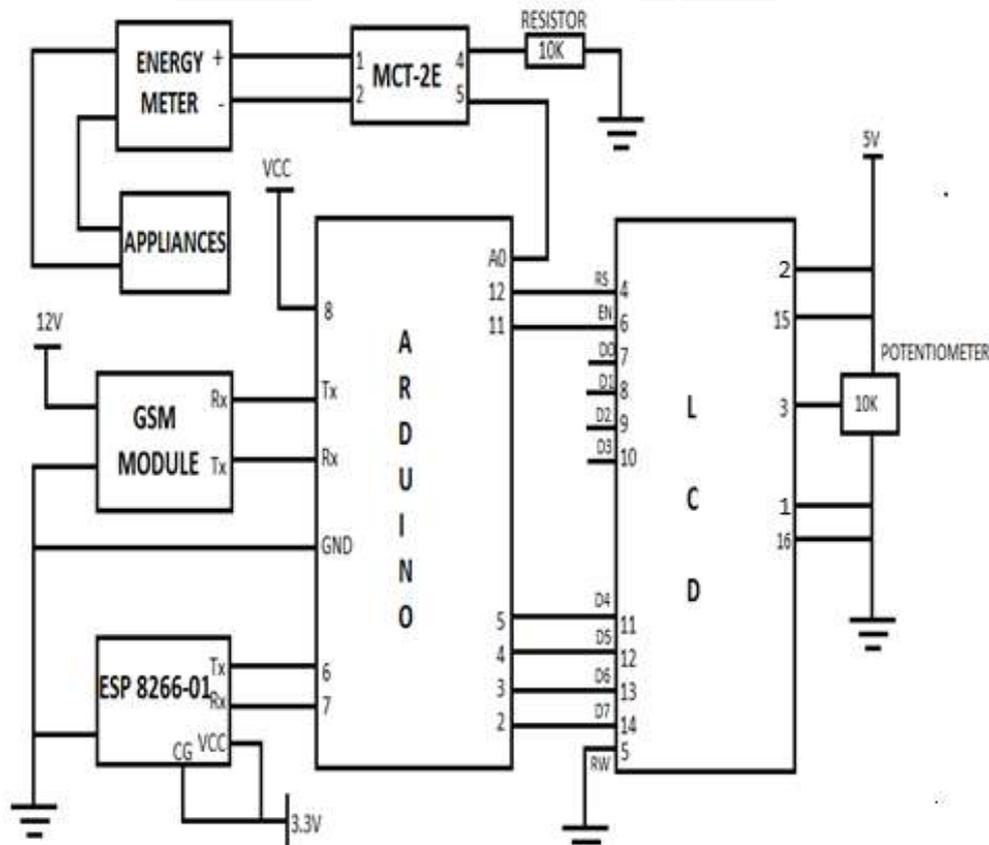


Fig.1: Block diagram

IV. IMPLEMENTATION AND RESULTS

Fig.2 shows a complete set up of GSM based energy meter .Microcontroller interfaced with GSM module and energy meter .Pulse and unit in energy meter are continuously increment according to power consumption. For implementation of AMR a SIM card is required for the GSM modem of energy meter .A Identification (ID) number allotted according to SIM contact number. According to requirement of data, electricity department sent a message to particular energy meter. When Arduino received a message, its respective port bit is high and an interrupt signal occurs. Microcontroller starts to execute to the interrupt service subroutine until it reaches last instruction of the subroutine. After executing of RET instruction microcontroller return to main program that is increment of pulse program. After Every one month data will be received by the electricity company automatically and Electricity Company can be access the system at any time on request.

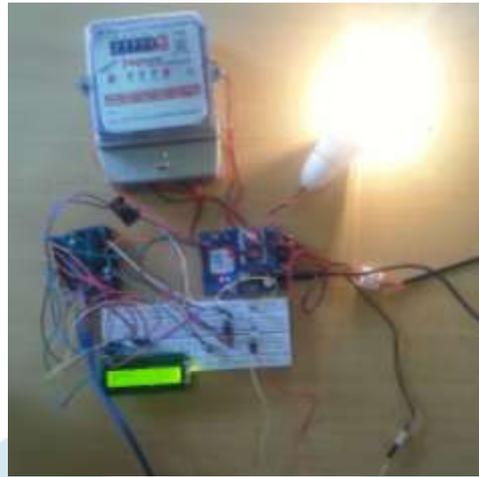


Fig 2: Prototype model of Automatic meter reading system

After bill calculation the bill sent to customer by post, by mail, by SMS and customer also see bill by login of our account. In fig.3 shows the e-mail alert of bill amount and deposit from electricity department to customer.



Fig 3: LCD displaying the total units consumed and the SMS of the bill

Electricity department also sent a SMS alert to customer mobile number for Bill information that is shown in fig.4.3. After that person can be pay our bill by access our login into web portable. Electricity bill payment online can be done via online pay where the person first read the statement of the amount pay and then pay the amount of the bill rather than going to the electricity department for pay of bill. Online electricity bill payment can be made through credit card, debit card or by net banking. The acknowledgement is mailed in form of SMS for the online bill payment within 12 hours of transition. This helps to avoid any late fees or payments which may affect your credit rating. So it saves lot of time and energy.

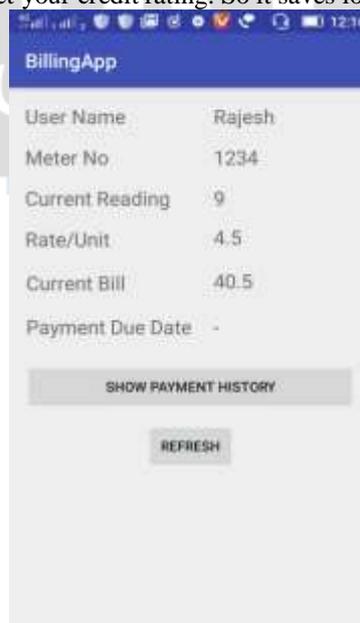


Fig 4: Snapshot of the android app for billing

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar.

V. CONCLUSION

If such a technology is developed then the conventional electricity bill payment procedure in India would be made simple. As witnessed a customer has to spend long hours standing in the queue waiting for his turn to pay the bill. But with this technology the customer has to suffer no such inconvenience. The customer can easily know his bill in his mobile phone at the month's end via an SMS and can pay his bill using his debit card without having to go anywhere, using the card reader embedded energy meter from his household's perimeter. Also, this technology can be further broadened to other bill payments such as water bill, newspaper bill etc.

In future we can also update the tariff within the energy meter by writing a program in the java and it must be connected to the energy meter using USB port which automatically updates the program in the micro controller. And we must also make easy to the customers for buying the watts using SMS request. This makes flexible for both user and the company.

REFERENCES

- [1] PriyaKamble, SonaliBodkhe, "A new approach for design and implementation of AMR in Smart Meter", International Journal of Advanced Engineering Sciences and Technology, Vol. 2, PP. 57-61, 25April 2011.
- [2] Abhinandan Jain, Dilip Kumar, JyotiKedia, "Smart and intelligent GSM based automatic meter reading system", International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol 2, Issue 3, pp. 1-6, May 2012.
- [3] H. G. Rodney Tan, C. H. Lee and V. H. Mork, "Automatic power meter reading systems using GSM network", IEEE, 8th International Power Engineering Conference, pp. 465-469, 2007.
- [4] Ashna K, Sudhish N Gorgre, "GSM based automatic energy meter reading system with instant billing", IEEE International conference held at Kottayam, pp. 65-72, 2013
- [5] G Thavasi Raja and T.D. Sudhakar, "Electricity consumption and automatic billing through power line", International Power Engineering Conference (IPEC), pp. 1411-1415, 2007.
- [6] Guilin Zheng, Zhifu Zhang, "Intelligent wireless electric power management and control system based on ZigBee technology", International Conference on Transportation, Mechanical, and Electrical Engineering (TMEE) Changchun, China, pp.1120-1124, December 1618, 2011.
- [7] Champ Prapasawad, Kittitachpornprasitpol, Wanchalermpona, "Development of an automatic meter reading system based on ZigBee pro smart energy profile IEEE 802.15.4 standard", International Conference on Electronic Devices and Solid State Circuit (EDSSC), pp. 1-3, Dec2012.
- [8] NajmusSaqibmalik, Friedrich kupzog, Michael Sonntag, "An approach to secure mobile agents in automatic meter reading", IEEE, International Conference on Cyberworlds, computer society, pp. 187-193, 2010.
- [9] SubhashisMaitra, "Embedded Energy Meter- A new concept to measure the energy consumed by a consumer and to pay the bill", Power System Technology and IEEE Power India Conference, 2008.

