Prepaid Energy Meter System using GSM Interface

B. Saritha[1], C. Laahiri[2], CH. Pamuleti[3]

[1]UG Scholar, Dept of ECE, Sreenidhi Institute of Science and Technology, JNTUH, India, Email:sarithabojjapuri13@gmail.com.
[2]UG Scholar, Dept of ECE, Sreenidhi Institute of Science and Technology, JNTUH, India, Email: laahirichikine@gmail.com.
[3]Asst Prof, Dept of ECE, Sreenidhi Institute of Science and Technology, JNTUH, India, Email: pamuletich@sreenidhi.edu.in.

Abstract: The aim of the project is to minimize the queue at the electricity billing counters and to restrict the usage of electricity automatically, if the bill is not paid. The project also aims at proposing a system that will reduce the loss of power and revenue due to power thefts and other illegal activities. The work system adopts a totally new concept of "Prepaid Electricity". The GSM technology is used so that the consumer would receive messages about the consumption of power (in watts) and if it reaches the minimum amount, it would automatically alert the consumer to recharge. This technology holds good for all electricity distribution companies, private communities, IT parks and self-containing housing projects. The implementation of this project will help in better energy management, conservation of energy and also in doing away with the unnecessary hassles over incorrect billing. The automated billing system will keep track of the real time consumption and will leave little scope for disagreement on consumption and billing. In this project work, an automated prepaid billing meter with smart card design for electrical and water billing is proposed. A graphical user interface (GUI) is developed using putty software to know the status of the bill. The proposed methodology will reduce the loss of power and less bill payments due to power thefts. Consumer will receive messages regarding consumption of electrical energy(in units) and balance money available in the smart card. This work will help in better electrical energy management and keep track of actual energy consumption.

Keywords: Energy Meter, GSM Technology, Microcontroller ATMEL 89S52.

I. INTRODUCTION

The GSM technology is used so that the consumer would receive messages about the consumption of power (in watts) and if it reaches the minimum amount, it would automatically alert the consumer to recharge. This technology holds good for all electricity distribution companies, private communities, IT parks and self-containing housing projects. The implementation of this paper will help in better energy management, conservation of energy and also in doing away with the unnecessary hassles over incorrect billing. The automated billing system will keep track of the real time consumption and will leave little scope for disagreement on consumption and billing. The present power usage reading is made manually by moving to the consumer locations. This requires large number of labor operators and long working hours to accomplish the task. Manual billing is sometimes restricted and delayed by bad weather conditions. The printed billing also has the tendency of getting lost. Over the last few years, Smart (Prepaid) Energy Meter has been proposed as an innovative solution aimed at facilitating affordability and reducing the cost of utilities. This mechanism, essentially, requires the users to pay for the electricity before its consumption. In this way, consumers hold credit and then use the electricity until the credit is exhausted. If the available credit is exhausted then the electricity supply is cutoff by a relay. Readings made by human operators are prone to errors. This project addresses the above mentioned problems. The development of GSM infrastructure in past two decades made meter reading system wireless. The GSM infrastructure, which has national wide coverage, can be used to request and retrieve power consumption notification over individual houses and flats. Apart from making readings using GSM communication, billing system is needed to be made prepaid to avoid unnecessary usage of power. The use of Prepaid Energy meter is still controversial. On the one hand, those that support the diffusion of prepaid meters claim that they benefit both consumers and utilities because they help users to consume more efficiently and to improve the management of their budget, while allowing firms to reduce financial costs. On the other hand, those that are against prepaid meters argue that their adoption is expensive for firms and risky for low income consumers, as the insecurity and volatility of their income may force them to make little use of the service, or ultimately, bring about involuntary self-disconnection.

II. SYSTEM ARCHITECTURE

The prepaid card is recharged for a certain amount and can be fed as input to the Microcontroller AT89S52. The AT89S52 is programmed such that power supply will be switched off by using relay when the recharged amount get used up. The GSM communication module is used to send a message to the consumer about the units of power consumed and their balance and also LCD display is used to display the balance amount.

A. Main Features Included In the Proposed Design:
Following features are included in the proposed digital prepaid energy meter

- Automated service disconnection and remote meter reading facility.

- Includes a mobile app from which user can remotely monitor his electricity usage.
- A web account is allocated to each customer to make online payments and monitor his/her usage.
- Payments can be made through credit cards and mobile service providers.
- Customer receives a notification SMS when the remaining energy goes below the first notification level of 5 kWh.
- Consumer will be alerted by a beep alarm when the remaining energy goes below the second notification level of 3 kWh.
- The connection gets disconnected when the remaining energy falls below the disconnection threshold of 1kWh and the user receives a sms verifying his supply is disconnected.

The connection gets reconnected after the account is recharged above the reconnection threshold of 6 kWh and the user receives a sms verifying his supply is reconnected.
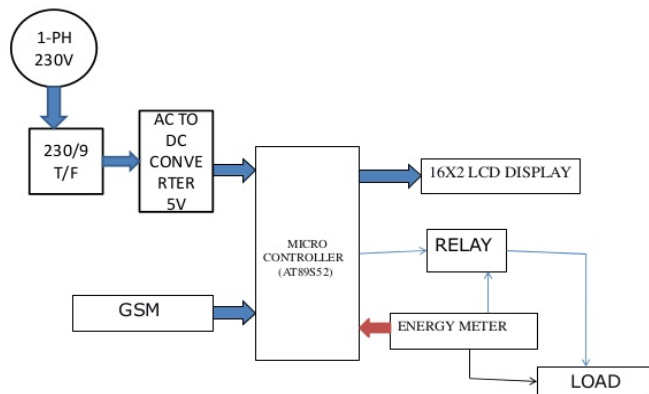

Fig.1. Block diagram of proposed system

III. WORKING PROCEDURE
The Microcontroller AT89S52 acts as the primary controller. The primary controller collects information from energy meter as well as from the smart card. Here, switches are used instead of the IC. Smart card, which is the switch, gives information about the limitation of units. The energy meter reading is compared with the smart card information by the microcontroller. Depending upon the result, the microcontroller will activate the buzzer if the credit is low and the Controller will trigger the Relay if the credit goes very low. The relay is the switching device to cut off and restore power supply. The LCD is interfaced to microcontroller using parallel port connection. The microcontroller based system, continuously records the readings. The coding emphasizes the fact that it reduces human labour but increases the efficiency in calculation of bills for used electricity. The user can be notified about the low balance in their credit with the help of the GSM module. The GSM modem is serially connected with the controller which is the major communication module between user and meter. The GSM uses its own programming makes use of messaging features of GSM AT command. And, once the relay is triggered, the electricity supply will be cut off. The power will be supplied again only if the meter is

recharged with enough credit. In this project the micro controller & the GSM unit is interfaced with the Energy meter/water meter of each house. Every house has a separate number, which is given by the corresponding authority. The GSM unit is fixed in the energy meter/water meter. The amount of consumption is stored in memory authority as SMS. Using this software we can send the SMS through Modem to that particular number which is assigned by these authorities and wait for the response. On other end the modem will receive the data in the form of a command and informs the controller to do the readings. After the readings the controller will send data to the modem. Modem, in turn sends data to the other end. To below diagram GSM technology is included to send messages to the customer about the balance amount and if the amount is totally used up then we shut down the power after alerting user.
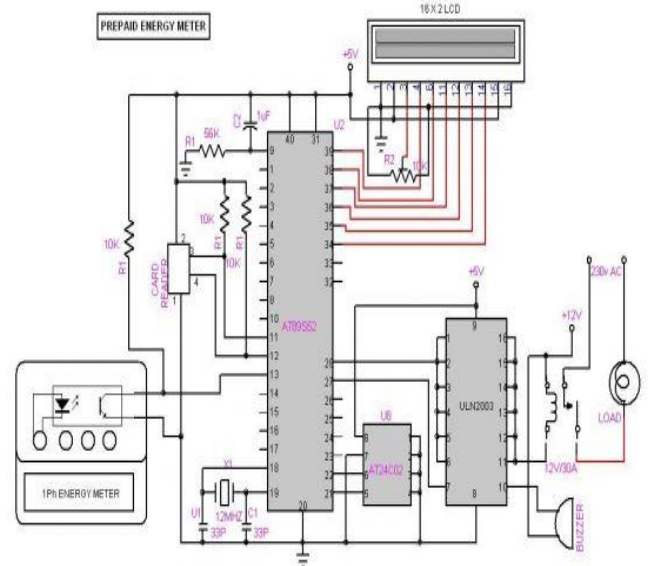

Fig.2. Circuit diagram of Prepaid Energy Meter.

A. Advantages
- Pay before use
- Recover money owed
- Lower overheads
- No bill production
- No bill distribution

B. Applications
- In Homes
- In Festivals where electricity is required just for a few days.
- Rental accommodation
- Industries and Factories
- In Malls

IV. CONCLUSION
The design of Smart Energy meter using GSM technology can make the users to pay for the electricity before its consumption. In this way, consumers hold credit and then use the electricity until the credit is exhausted. If the available

credit is exhausted then the electricity supply is cutoff by a relay. An arrangement is also made to intimate the user with the help of GSM communication module when their credit in their balance goes low. This system has been proposed as an innovative solution to the problem of affordability in utilities system. Since a microcontroller based system is being designed, the readings can be continuously recorded. This reduces human labour and at the same time increases the efficiency in calculation of bills for used electricity. Smart energy meters will bring a solution of creating awareness on unnecessary wastage of power and will tend to reduce wastage of power. This module will reduce the burden of energy providing by establishing the connection easily and no theft of power will take place. Prepayment systems have been proposed as an innovative solution to the problem of affordability in utilities services. In spite of being a popular system in European and African countries, the use of such mechanisms remains controversial. Among the main arguments in favor of its dissemination are the advantages concerning lower costs of arrears, running costs and finance charges for the service provider and the better allocation of resources it implies for users. The arguments against prepaid meters are based on the higher cost of the technology and the possibility of self-disconnection of low-income users.

V. FUTURE SCOPE

We are sending bills through post, instead of this, we can add a printer in every house and if we give print command from the server, it will print the bill and the user can get the bill over there only.

VI. REFERENCES

[1] Loss.P.A.V, Lamego. M.M and Vieira.J.L.F, "A single phase microcontroller based energy meter", IEEE Instrumentation and Measurements Technology conference St. Paul, Minessota, USA, May 18-21, 1998.

[2] Saptarshi De, Rahul Anand, A Naveen and Sirat Moinuddin, "E-Metering Solution for checking energy thefts and streamlining revenue collection in India", Student Member, IEEE, 2003. [3] Chandler, T. 2005. "The technology development of automatic metering and monitoring systems". Power Engineering Conference, 2005. IPEC 2005. The 7th International, Vol., No., pp.1-147.

[4] Ali Zaidi.S.K., "Design and implementation of low cost electronic prepaid energy meter", Multitopic Conference, 2008. INMIC 2008. IEEE International 2008.

[5] Syed Khizar Ali Zaidi I, HuraMasroor I, Syed Rehan Ashraf I and Ahmed Hassan, "Design and Implementation of Low Cost Electronic Prepaid Energy Meter", NED University of Engineering and Technology, Karachi, Pakistan, 2010.

[6] HuraMasroor I, Syed Rehan Ashraf I and Ahmed Hassan, "Design and Implementation of low cost Electronic Prepaid Energy Meter', NED University of Engineering and technology, Karachi, Pakistan, 2010.

[7] Jain and Bagree , "A prepaid meter using mobile communication", International Journal of Engineering, Science and 164 Technology, Vol.3, No.3, 2011, pp. 160-166.

Author's Profile:

Chikine Laahiri is perusing her B.tech course in ECE Department from Sreenidhi Institute of Science and Technology, Autonomous college, (Affiliated by JawaharlalNehru Technological University, Hyderabad) Ymnampet(V), Ghatkesar(M), Hyderabad, India.

Bojjapuri Saritha is perusing her B.tech course in ECE Department from Sreenidhi Institute of Science and Technology, Autonomous College, (Affiliated by Jawaharlal Nehru Technological University, Hyderabad) Ymnampet(V), Ghatkesar (M), Hyderabad, India.

Dr. Ch.Pamuleti currently working as Associate professor in Sreenidhi Institute of Science and Technology, Hyderabad. He is having 10 years of experience in Academic.