

April 2018

Power Theft and Prepaid Energy Meter with GSM Technology

^{#1}G. Thomas Edwin, ^{#2}T. Gowthameshwar Rao, ^{#3}P. Prashanth

Assistant Professor¹, UG Scholar^{2,3}

Gates Institute of Technology, Gooty, Andhra Pradesh, India

Abstract

This paper presents the design and modeling of a GSM-based Energy Recharge System for prepaid Metering and power theft. The present system of energy billing in India is error prone and time and labor consuming. Errors get introduced at every stage of energy billing like errors with electromechanical meters, human errors, processing errors. The aim of the project is to minimize the error by introducing a new system of Prepaid Energy Metering using GSM. The GSM module provides a mode of communication between the user/ and provider. This will enable the user to recharge his/her electricity account from home. We can easily implement many add-ons such as energy demand prediction, real time dynamic tariff as a function of demand and supply and so on. Here we are adding one more future i.e. power theft

Keywords- Energy meter, GSM technology, Microcontroller AT89S52, Prepaid Card, Relay, Putty Software.

1. Introduction

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 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. It replaces traditional meter reading methods and enables remote access of existing energy meter by the energy provider. Also, they can monitor the meter readings regularly without the person visiting each house. Recent technology mainly focusing on power theft also.

2. Related Work

Mr. Nazir Bin Abdullah [1], developed an automatic meter reading system (Automation of Residential Electricity Cut off Using Embedded Controller). In 2012 for domestic user. In this project he used GSM modem for transmitting and receiving information, both sides means user side and energy provider side. Mr. Hung Cheng Chen [2] proposed a wireless automatic meter reading system in 2012. In this project he used ZigBee module on both sides. This technology is chip and low cost. Mr. Alauddin Al -Omary[3] develop an automatic meter reading system using GPRS technology. In 2011. MR.LI Quan Xi [4] design an automatic meter system based on ZigBee and GPRS system. In 2010. Mr. H.G. Rodney Tan [5] develop an automatic power meter reading system using GSM network. in 2007.In this system GSM digital power meter installed in every consumer unite and electricity e-billing system at the energy provider side. Mr. Mejbaui Haque [6] develop a microcontroller based single phase digital prepaid energy meter for improved meter and billing system. Amit Jain [7], proposed a prepaid meter using mobile communication in2011.In this system he used controller unite, prepaid card and communication module. Fawzi Al-Naina and Bahaa Jalil [8], built a prototyping prepaid electricity meter system based on RFID .This system is divided into two part such as



client and server .The client consist of a digital meter based on a microcontroller and an RFID reader and the server consist of a PC with MySQL database server. The client installed in each house and the server installed in local substation.

3. Literature Survey

Automatic Power Meter Reading and Distribution Control Using GSM Networks, mainly focused on measurement of power from the consumer side that has been consumed by them. It is an integration of single phase class T, IEC61036 Standard Compliance Digital KWh Power Meter, Power to Communication (P2C) interface board and a GSM modem which utilize the GSM network to send the power usage reading back to energy provider wirelessly. The system mainly focuses on taking to an account of power consumed by the user. The digital power meter is used to measure the power consumption drawn from the energy provider substation to the consumer in KWh unit. A single phase digital Watt Hour Meter ATEC12and ATEC was chosen for GSM Power meter implement the system consists of optocoupler instead of Electromagnetic Relay which may require a step-down transformer to transfer the amount of power consume and will also, result in complexity in circuit. The Power to Communication (P2C) is used to interface the impulse and synchronization count from the power meter optocoupler circuit and to store the power meter reading into the internal non EEPROM memory at single impulse count interval. In the case of power failure, the last meter reading will be stored in EEPROM. During the time of power restoration, the microcontroller circuitry used here retrieves back last meter reading and to continuous synchronous with the digital power meter. At the time of normal operation, the Power to Communication interface board used to retrieve the last meter reading from the EEPROM memory. Here the GSM Power Meter and SMS Gateway uses normal SIM card phone number. The billing notification to customer send by SMS, E-mail and hardcopy printing for postal. The complete demonstration of GPMDC from meter reading, notification, payment, distribution control of power cut-off and power restoration are being done.

4. Hardware Components

4.1 Energy Meter

Energy meters, the only direct revenue interface between utilities and the consumers, have undergone several advancements in the last decade. The conventional electro-mechanical meters are being replaced with electronic meters to improve accuracy in meter reading. Asian countries are currently looking to introduce prepaid electricity meters across their distribution network, buoyed up by the success of this novel methodology in South Africa. The existing inherent problems with the post-paid system and privatization of state held power distribution companies are the major driving factors for this market in Asia. When the card is inserted, the energy meter reads it, connects the supply to the consumer loads, and debits the value. The meters are equipped with light emitting diodes (LED) to inform consumers when 75 percent of the credit energy has been consumed. The consumer then recharges the prepaid card from a sales terminal or distribution point, and during this process any changes in the tariff can also be loaded in the smart card.

4.2 GSM Modem

This GSM modem is a highly flexible plug and play quad band GSM modem for direct and easy integration to RS232. Supports features like Voice, Data/Fax, SMS, GPRS and integrated TCP/IP stack.

4.3 Liquid Crystal Display

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons: 1. The declining prices of LCDs. 2. The ability to display numbers, characters and graphics. This contrasts with LEDs, which are limited to numbers and a few characters. 3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.

4.4 Relay

It is on/off switch which uses 12V supply. A relay is an electrically operated switch. A simple electromagnetic relay consists of a coil of wire wrapped around a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a



movable iron armature, and one or more sets of contacts.

5. Proposed System

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 cut-off 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. Mainly it shows the power theft also through GSM.

6. Working

The proposed model has the microcontroller as Central Processing Unit. The whole system is interfaced with 8051 micro controllers. The GSM modem is serially connected with the controller which is the major communication module between User and provider. The GSM uses its own network for the transfer of information. Special coding in embedded c is used for programming 8051 microcontroller using programmer Hardware along software. The relay acts as switching device to cut off and restore power supply.



Fig.1 Block diagram of prepaid energy meter with GSM technology

The LCD is interfaced to microcontroller using parallel port connection. In this project the Microcontroller based system continuously records the readings and the live meter reading can be sent to the Electricity department on request. This system also can be used to disconnect the power supply to the house in case of non-payment of electricity bills. A dedicated GSM modem with SIM card is required for each energy meter. The microcontroller pulls the SMS received by phone, decodes it, recognizes the Mobile no. and then switches on the relays attached to its port to control the appliances. After successful operation, controller sends back the

p-ISSN: 2348-6848 e-ISSN: 2348-795X Volume 05 Issue 12 April 2018

acknowledgement to the user's mobile through SMS. The coding emphasis the fact that it reduces human labor but increases the efficiency in calculation of bills for used electricity. The user will have a universal number and they can recharge outlets of electricity board. The acknowledgement of recharged coupon detail will come to notice of the consumer and will get displayed in LCD module. So, this process 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. The LCD display will display the used amount and balance amount that can be used.

7. Results



Fig.2 Hard ware of energy meter

8. 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 cut-off by a relay. This reduces human labor 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. This paper work exposes the purpose of energy monitoring and controlling by implementing prepaid system. It is hoped that this work helps the consumers for better energy management and its utility in the distribution system for economic liability of the Electrical Boards.

REFERENCES

[1] Jubi.K, MareenaJohn, "Prepaid Energy Meter with GSM Technology", AIJRSTEM, pp. 195- 98, June-August, 2013.

[2]"SIM300 Hardware Interface Specification", 2006-04-05,SIM300_HD_V2.02

[3]Dr.Boyina.S. Rao, B. Gnanasekaranathan, M. Raguram, S. Pravinkumar, P. Kamalesh, "Domestic Prepaid Energy Distribution System for saving of Power Consumption",IJAET/Vol.III/ Issue II/April-June, 2012/26-29.

[4] Bhavna Patel, ShrikantMhaskar, "Voucher Based Prepaid Electricity Supplier With Auto Cut Off", IJIIT|Volume-II|Issue-I|2013-2014 July |Paper-03.

[5]Dr. K. Sheelasobanarani1, S. Dinesh Raja2, B. Dhanaraj3, K. Manickam4, K. KarthickRaja5. "A Prepaid Energy meter for efficient Power Management", International Journal of Emerging Technology and Advanced Engineering,Volume 4, Issue 3, March 2014

[6]Bharat Indorey, M.Lokhande, "ZigBee Based Advanced Energy Prepaid Meter", International Journal of Innovations in Engineering and Technology (IJIET), Volume 3 Issue3 February 2014