International Journal of Combined Research & Development (IJCRD)
eISSN:2321-225X;pISSN:2321-2241 Volume: 4; Issue: 3; March -2015

GSM BASED AUTOMATIC ENERGY METER WITH INSTANT BILLING

Alka Kumaran[1], Anibir Kaur Gandhi [2], Uma Mounika Karukonda[3], Vaishnavi Iyengar [4]
[1,2,3,4]Department of Electronics and Telecommunication,
SIES Graduate School of Technology,
Sri Chandrasekarendra Saraswati Vidyapuram,
Sector-V, Nerul, Navi Mumbai - 400706, Maharashtra.
[1] alka9693@gmail.com,[2]anukaur08@gmail.com,[3]umamaunica@gmail.com, [4]vaishnavingr@gmail.com

***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. The project is designed for reading electrical energy consumed in units and in rupees to display on an LCD screen to the user. This data is also provided to the electrical department using GSM technology for billing purposes.**

***Keywords*-** GSM, electricity bill, SMS, 8051 microcontroller family, electrical energy, electricity department

I INTRODUCTION

Since the supply of power is limited, as a responsible citizen, there is a need to use electricity in an improved and efficient way. In this paper, a new concept of energy meter will be discussed, where energy consumption will be indicated using the LCD to the consumer. Also this system helps to eliminate the drawbacks of contemporary billing management system, such as to take the reading from the meter, to create the bill, to print the bill, to send the bill to the proper address and to collect the amount for the bill. This system can effectively reduce the manpower required to a great extent. The power consumption in units and its corresponding amount which is displayed on the LCD will be sent to the electricity billing department via SMS using GSM technology. There are clear domino effect from many countries where this system has reduced the usage (wastage) by a great quantity. Additional advantage of this system is that the human errors made during reading meters and processing bills can be reduced to a great amount. Wireless meter can be used in residential apartments and especially industrial consumers where bulk energy is consumed. Using this technique the department as well as the consumer can keep track of the consumption in terms of units as well as money, thereby, emphasizing the importance of electricity conservation

II. NEED OF THE PROJECT

Billing is a critical function of Electricity board to get a meter reading. Meter reading, even though looks simple, is far from simplicity and involves processes that can give various problems. Most problems, currently seen, result from the manual

processes followed. Calculation errors, delays in system updating and fault tracking issues are the major problems that companies find difficult to find answers for.

Prevailing billing system has a set of major disadvantages which are given below:

i.) Erroneous Readings – This involves errors present in the meter reading which are committed due to human mistakes.
ii.) Easy Manipulation – Since all data here are taken manually, dates can be easily manipulated by third parties which affect the EB office and the customer.
iii.) Manual Labor – The amount of workforce involved in this prevailing EB system is too large as the EB people have to visit many areas at roughly the same date.
iv.) Time Consuming – This system takes a lot of time to go personally to the customer's house and take the readings.
v.) Inability of recording data -Consumer can't keep the track of his consumed units until the end of the month.

This paper suggests a GSM based system to collect, process and notify consumers about consumption. The burden on the Meter Reader is lessened and other new features have also been introduced.

Our project eliminates:

i.) The need for employing EB meter readers and this set of employers can be used elsewhere.
ii.)The amount of time spent in doing all these works manually can be reduced because of this kind of implementation
iii.)Customer interaction with the company is improved and customers can easily view their current electricity usage and can also carry out bill payment.
iv.) Ensuring the authenticity of the bill.

III. Literature Survey

Global Analysis regarding the smart billing system was done. Several countries have switched to more efficient technology.
Countries that have upgraded their billing system:
Australia
Canada
Italy
Japan
Netherlands
New Zealand
Nordic Countries
Spain
United Kingdom
United States
Countries imminent to upgrade:
France
Ireland

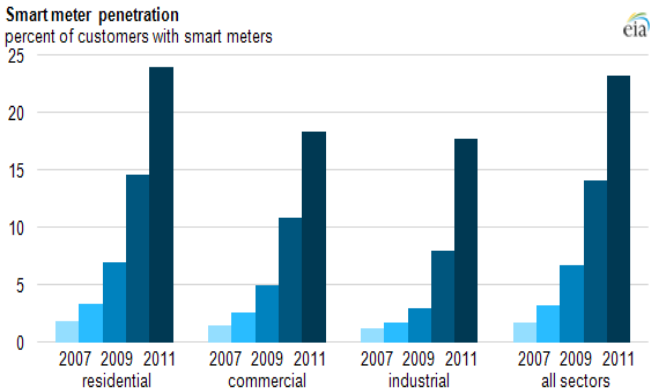

Figure 1. Graph showing smart meter penetration in US markets

It was found the two major methods were used which are mentioned below

1. AMR

Automatic energy meter, or AMR is the technology of automatically collecting consumption, diagnostic, and status data from water meter or energy metering devices (gas, electric) and transferring that data to a central database for billing, troubleshooting, and analyzing.

2. AMI

Advanced metering infrastructure (AMI) is an architecture for automated, two-way communication between a smart utility meter with an IP address and a utility company. The goal of an AMI is to provide utility companies with real-time data about power consumption and allow customers to make informed choices about energy usage based on the price at the time of use.

Electric meters with enhanced communication capabilities—an essential component of the smart grid—are becoming more prevalent.

In 2011, more than 23% of all U.S. electrical customers had smart meters

In 2012, 533 U.S. electric utilities had 43,165,185 advanced ("smart") metering infrastructure (AMI) installations.

About 89% were residential customer installations.

Advanced metering infrastructure includes meters that measure and record electricity usage.

IV. Principle

The main principle of the project is to develop an efficient billing system. The microcontroller takes the reading from the energy meter and displays the reading on the LCD. The reading of the energy meter is also sent to the electricity department through GSM modem.

This project is powered by an on-board power supply which takes the ac power and converts it into dc power that is fed to on-board devices and integrated circuits.

V. Implementation

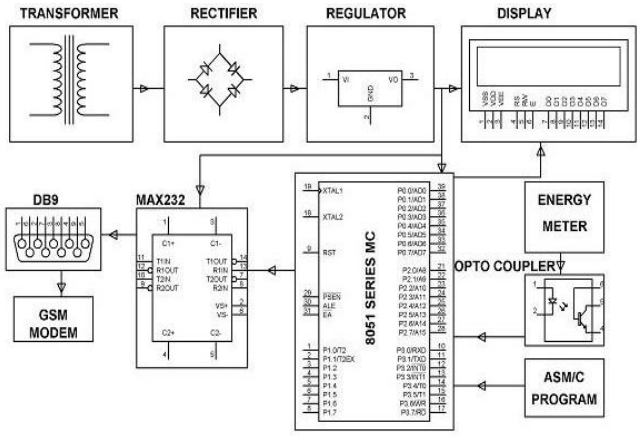

Figure 2. Block Diagram of the project

The actual implementation takes place in the following manner.

i. The consumer gets the connection of the new circuit done with the existing energy meter and the circuit is switched on

ii. The consumer inserts the SIM card provided by the electricity department in the circuit's GSM module

iii. Consumer informs the electricity department about the status and then the EB gives a miss call on the SIM card and gets its number registered on which it will be receiving a particular users billing information

iv. The readings from energy meter are then transferred into the circuit via opto-coupler
v. A counter is employed which counts the number of pulses given by energy meter's microcontroller.
vi. The energy meter and AT89S52 microcontroller are interfaced and pulse information is shared.
vii. The external microcontroller that is AT89S52 keeps on counting the incoming pulses and maintains the count in its memory.
viii. When the number of pulses equals to 3200, one unit of power is consumed and then it is multiplied by the standard tariff and displayed on the LCD
ix. This power consumed and corresponding amount is then transmitted to the GSM module using serial communication.
x. The user has an option of making online payment. If the user wishes to make payment then the person has the freedom to do so. Along with these details, projected numbers of units are also displayed. Also the option of switching off any electrical appliance if it exceeds particular energy consumption level is possible through this application

The project mainly uses the following resources:
1. Analog Energy Meter
2. Microcontroller- AT89S52
3. LCD Display
4. GSM Module- SIM300
5. Opto-coupler

1. Interfacing SIM300 with AT89S52:
The GSM module SIM300 is interfaced with AT89S52 through UART port. Serial communication takes place between these two components. AT89S52 can be programmed by using C programming. SIM300 is accessed using AT commands. So to implement these two programming tasks simultaneously we use AT commands within the C program. The AT commands can be implemented using applications like Turbo C/C++, Microsoft Visual Studio, Command prompt etc. Such methods will employ AT commands in the syntax of standard computer languages like C, C++, Java, C# etc. Let us see implementation of an AT command for example of write function that is AT <"...">. We now use C syntax to implement it. The syntax will be such that the serial port will be activated first through C program; then the actual commands can be used while programming the port.

Code Snippet:
SET 1)
Void setup()
{
Code that will execute once:
Functions
• 1. Setting baud rate for UART 1 to connect with SIM300 module
• 2. Setting SMS format to text mode (AT+CMGF=1)

• 3. Configuring normal I/O pins
}

SET 2)
Void loop()
{
Code that will execute again and again:
Functions:
• 1. Pulse Measurement of the meters
• 2. Displaying the consumed units and corresponding amount on LCD
• 3.Sending message to EB regarding consumed units and corresponding amount
}

2. Electricity Board end:
The changes that the electricity board needs to incorporate so as to use the proposed metering technology are described further. Firstly, the board needs to maintain a complete database of all its consumers. The entries may include ID, name, meter ID, address, contact number, payment status, log of requested readings etc. The server needs to be developed so that the system is automatic. The database and server can be developed using either Microsoft SQL server, MySQL. To enable the server for SMS communication, we need to use a gateway. The gateway can be software which will allow computers to send/receive messages either using another GSM module or using IP based SMS. The examples of such gateway softwares are: Ozeki NG SMS server, diafaan etc. Diafaan is one such system which is easily compatible with various servers. The connectivity between server and gateway can be established using ODBC connectivity. The proceedings at electricity boards' end are described: Whenever a user requests reading, the request is received at server end. This request is then routed to the corresponding meter and controller system. The response received by meter is first received at server end. The database tables are updated with latest values of reading and billing amount. The updated data is then received back by the user.

3. Consumer's end:
The user will be regularly updated about his/her power consumption. The user can thereby keep control over his/her power consumption and use electricity efficiently.

VI. Result

A fully automated energy meter reading system was developed to collect, process and notify the consumption. The project takes care of the convenience of all sets and sections of consumers and at the same time presents an efficient management system to the electricity board. Features like electricity bill prediction, control over the energy consumption, operation on various platforms like SMS, GSM technology and many other potential extension properties make this project unique.

VII. Analysis

Project compatibility with existing systems is fine. The existing system doesn't need to change; it only has to be augmented with the project. This process will be both easy and economical. Moreover the project can also be extended to serve with any home

automation system that will allow keeping a check on utilities that consume more power. The same project can be extended to multiple meter configuration for residential buildings and complexes where there are multiple meters installed at one place. All that is required is a small change in the logic of the project and a few additional circuitries. So without much additional cost our project will cater to extended application.

VII. Conclusion

Electricity bill prediction in between the month is now possible by taking into account on the current consumption rate of the user and the seasonal trends in consumption. This can help the customer keep a check on his consumption levels. Thus the project also promises an indirect control on electricity usage, leading to conservation of the precious energy resources. The features of the proposed system can be summarized as follows:

1. Provides user friendly remote energy meter monitoring.
2. Supports controlling of meter.
3. Non-volatile memory based energy-reading storing.

The system can be used for automated metering in the Electricity departments, Household Energy meter monitoring, Railway electrical systems, Industrial Energy remote monitoring, and Remote controlling systems.

Acknowledgment

We acknowledge Dr. Atul Kemkar, HOD under department of electronics and telecommunication and our project guide Mrs. Sonal Jatkar for their constant guidance and support that led us to work efficiently and complete this project in stipulated time without much hassle.

References

[1] Ashna K., "GSM Based Automatic Energy Meter Reading System with Instant Billing", 978-1-4673-5090-7/13/$31.00 ©2013 IEEE

[2] Yujun Bao and Xiaoyan Jiang, "Design of electric Energy Meter for long-distance data information transfers which based upon GPRS", ISA 2009. International Workshop on Intelligent Systems and Applications, 2009.

[3] H.G.Rodney Tan, C.H. Lee, V.H.Mok, "Automatic power meter reading using GSM network", The 8th International Power Engineering Conference (IPEC 2007).

[4] Vivek Kumar Sehgal, Nitesh Panda , Nipun Rai Handa, "Electronic Energy Meter with instant billing", UK SIM Fourth European Modelling Symposium on Computer Modelling and Simulation.