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AUTOMATED E-BILLING AND POWER CONTROL SYSTEM THROUGH POWER LINE COMMUNICATION

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ABSTRACT

Now a days electricity is very important to carry out various work which need electricity. And because of that, proper utilization of this commodity is of immense important to us. That's why, it is required to measure power consumption. Previous system require an individual and agent to physically come and take down the readings and report to house hold or office the amount one has to pay. The objective of this paper is to measure and monitor the electricity consumed by consumers in a locality and transmitting the measured reading between the consumer and utility. The concept of Power Line Communication is used for the transfer of data between consumer and utility. Power Line Communication uses the high power line for the communication. The vital merit of this system is that no additional transmission line is needed for the transmission of data. It gives the useful functionality of switching the power ON or OFF to the user based on the signal sends to it from the controller.

Keyword: PLCC:Power Line CarrierCommunicationmodem , EB: Electricity Billing , AMR: Automatic meter reading

I. INTRODUCTION

A. Power line communication

Here the power line carrier communication modem is useful to send and receive serial data over existing AC power lines of the building. It has large immunity to electrical noise patience in the power line and built in error checking therefore it cannot give out corrupt data. The modem is in the form of a ready to use circuit module. It is capable of providing 9600 baud rate less rate bi-directional data communication. Due to small size it can be integrated and become part of the consumer's power line data communication system.

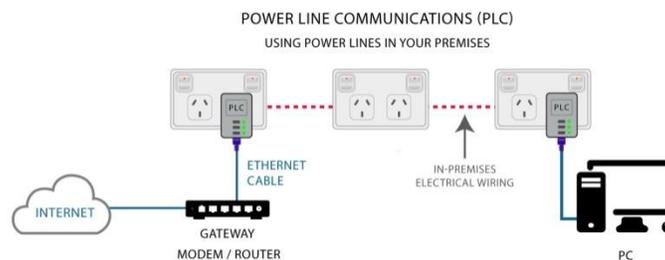


Figure1.PLC

B. Hardware required

1) Digital energy meter:

The Digital energymeter is a high-accuracy, fault-tolerant electrical energy measurement IC that is intended for use with 2-wire distribution systems. It is electrically fed and calm of electronic controllers. It assemble an interface for the data to be transmitted from the remote terminal to the isolator block.

2) Optocoupler:

In this project, an electrical isolation between energy meter and power line modem is very important. For this purpose an optocoupler is used.

3) Microcontroller:

Then the microcontroller which has been used in project is AT mega 328, Flash, EEPROM, and SRAM are all integrated onto a single chip, removing the need for external memory in most applications. Some devices have a parallel external bus option to allow adding additional data memory. Almost all devices have serial interfaces, which can be used to connect larger serial EEPROMs or flash chips.

4) LCD:

LCD stands for Liquid Crystal Display. It is a display device which display the information provided to it. Its shape and size varies for different applications.

5) PLC modem:

Power line modem is useful to send and receive serial data over AC mains power lines of the building.[1]

II. LITERATURE REVIEW

In the previous technologies for the automatic meter reading there are many factors which are missing that is speed and also due to the use of GSM the interference problem can be there. When there is the use of android technology for the automatic meter reading there is less memory storage. Also if the network connection is weak then there may be the loss of data connection. Now the power line carrier communication has also been used as a technology but still there is only the advancement in automatic meter reading of each house from EB office. And the automatic power controlling is not present there so it is less advantageous than the system which has been proposed in this paper.

So here in our project the power line communication modem is used but for automatic meter reading as well as for the power supply controlling through GUI, if the bill has not been paid by the customer in time. And after the payment of bill automatically the power supply connection will be ON of that customer's house by the EB officer.

III. PROPOSED SYSTEM

C. System Description:

The customer section consists of digital energy meter. The output of the processor is a digital pulse which depends upon the load used. These digital pulses are given to the input of second section through the optocoupler. Hence the energy consumed by the consumer is measured digitally. The control section in customer section is the heart of the system which consists of the micro controller. For every 3200 pulse the micro controller receives it increases the number of units consumed by the consumer by 1 which is stored in the EEPROM. The vendor section consists of the PLC MODEM which is a transceiver i.e. it can receive as well as transmit data. The PLC modem receives the input from the microcontroller and transmits it to the EB office. These are received by the modem placed in the EB office.[1]

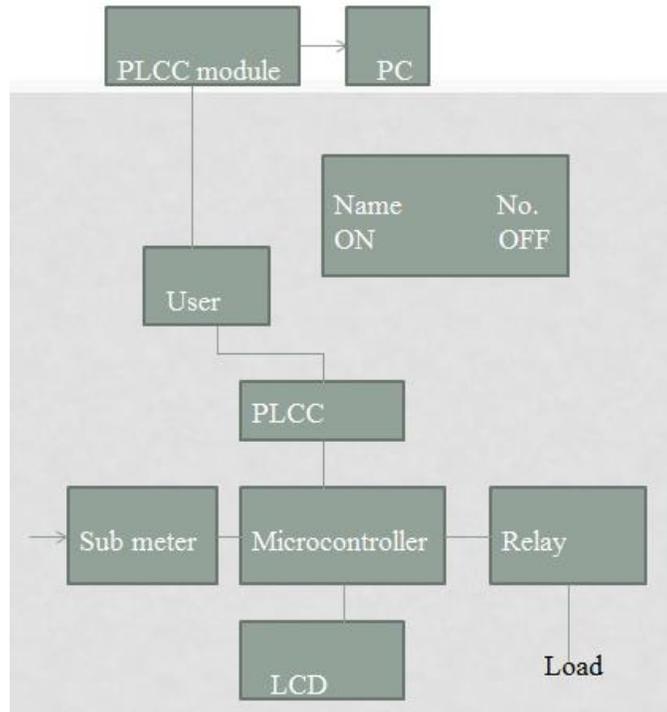


Figure2: Practical implementation of automatic meter reading

In the above system the microcontroller will first read the data in the form of units present on the sub meter. Then the readings will get send in the forward direction towards the PLCC. In this project we required total two PLC modem. One for transmitter and another for receiver to decode the data. Afterwards the EB officer will save all the data in the PC of each house and accordingly he will send the amount of bill customer has to pay.

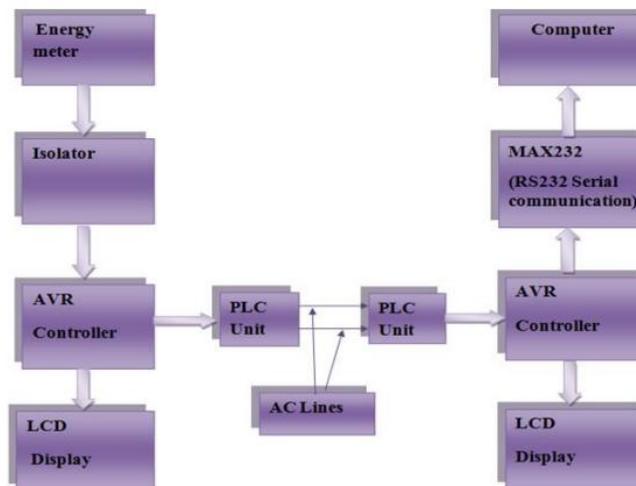


Figure3. Alternative diagram of Automatic meter reading

D. AMR (Automatic Meter Reading)

Basically the AMR is a power measuring device , generally it is being used in measuring electricity , gas , water consumption in many countries on the world since it has a lot of advantages that the old analog meters doesn't have. It has advantages in safety , real time measuring and time save as well as it has a better user interface and digital data analysis . AMR appears in several types depends on measured data type and data transfer technologies . We can say that AMR is the best solution to measure,collect and analyze data for the big networks like the electricity transmission and distribution network in Egypt . In the year 1886 , the first AC transmission line was installed . Since this age , it was very important to measure the energy that consumers pay for . Hence , the first generation of power meters was found which we know as (Watt-Hour meter) . As most of us know , the first generation(traditional meter reading devices) is being used till now in many places .It has a lot of limitations that we will mention later . To overcome this limitation we have to modify a new reading system that provides remote reading, safety , on-time readings and a simple user interface . That is what AMR provides successfully.[2]

E. Description of customer and vendor unit

The first one is the customer section consists of digital energy meter and control system. The current transformer (CT) and voltage transformer (VT) of the specified rating are used. The output of the processor IC is a digital pulse, which depends upon the load used. These digital pulses are given as an input to the second section through the optocoupler. And that's why the energy consumed by the consumer is calculated digitally. The control system in customer section is the heart of the system which consists of the micro controller(ATMEGA328). For every specified number of pulse the micro controller receives it increases the number of units consumed by the consumer by 1, which is stored in the EEPROM. This is then displayed on LCD. The vendor unit consists of the MODEM which is a transceiver i.e. it can receive as well as transmit data. The modem receives the input from the microcontroller and transmits it to the EB side. These are received by the modem placed in the electricity billing side and sent to the PC. The tariffs are calculated using VB software by the PC and sent to the micro controller through the same pair of MODEM. Hence the number of units consumed and the amount is displayed on the LCD panel.[3]

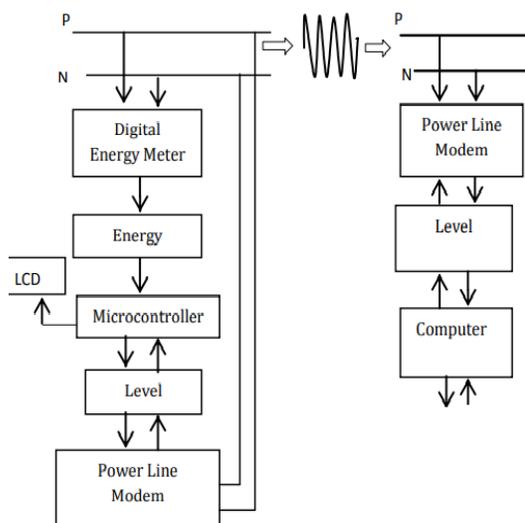


Figure 4. Customer and vendor unit

Though many technological innovations are taking place in this world, existing electricity consumption billing process seems in India to be very obsolete and does not meet the latest technology available. In this paper, the above said process is totally automated and the communication is made possible entirely through the power line. Not only the billing, even the control of system is fully automated by this technique i.e. when a consumer fails to pay his bill consumption within a given period of time the supply automatically gets cut off to his house and the

restoration is done only when the bill is cleared. The currently used system involves the user to go up to the EB office to manually pay his bills. The readings are taken using the analog meter present in the customer's house. The readings are taken using an employee working at the EB office. This system is having some of limitations like erroneous readings, easy manipulation, manual labor and time consuming. In the proposed system, the analog energy meters are replaced by digital meters which is advanced. The meter readings in the form of digital data are transferred from the customer end to the Electricity billing office through power line. [4]

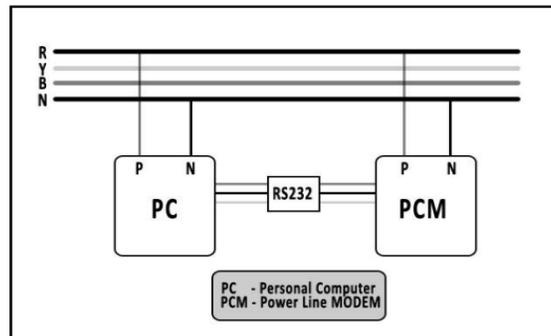


Figure 5: Connection between PLC and PC

F. Power line communication and computer connection

There is a cable which is used for serial data transmission. Thus the connection between the computer and the PLM is in the form of serial data transmission with a start byte and end byte attached to the data. In the prototype software a specially designed binary enables the power line modem to get the KWh readings from each energy meter on the consumer end. A protocol is sent from the PC to the meter requesting the meter reading. The meter in turn sends back the meter reading value. A data base management system is maintained in the PC to store the power consumption details of the customers. These details are processed to obtain the bill that is to be paid by the customers. As soon as the bill is generated the grace time for the consumer is given for paying the bill. The computer continuously monitors, whether the bill is cleared in time. If not, the PC sends the trip signal via concentrator, through the power line, to the node at the consumer end. The supply is again restored back only when the bill is cleared. [5]

We propose to create such energy meters, which will have the de multiplexer or decoder circuits to decode this information. This data will then be read by an AVR microcontroller circuit also built in the energy meter.

Based on the information, which is nothing but the billing status of the consumer, indicating whether he has paid his bill or not, the microcontroller circuit will trigger a relay based switching circuit, which controls the power supply to the customer. The information will source, or at the distributing local substation, by the electric company officials, by an encoding/multiplexing circuit. It will contain the information of all consumers, being retransmitted periodically. We will demonstrate this system with a single energy meter, due to budget constraints. [6]

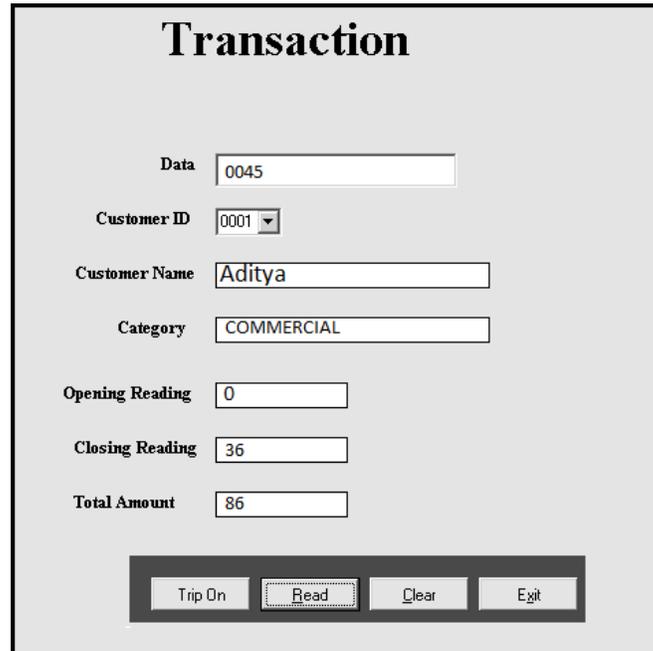


Figure 6: Billing form

Above figure is showing the billing form on which the amount which should be paid by the user is also shown. Many problems had encountered during implementation but finally design had been successfully implemented, simulated, and results are taken. It is also researched several ways to improve the system. The GUI could be used which is in built in the matlab to communicate with the low level instructions in the Power PC micro-controller to give a user-friendly interface for both transmitter and receiver.

IV. CONCLUSION

The system which has been proposed saves time and money, increases customer satisfaction, reduces complaints and worker injuries and can pay for itself in a handful of years. Utilities should look beyond basic meter reading expenses to determine how an automated system will drive efficiencies and savings throughout many departments in the organization. This proposed Automated EB model includes an office module which has a PC with its back end connected to a database. The other module is the customer home module which is present at the home this module is used to make note of the amount of power consumed by the customer and after a period of 1 month it sends to the PC in the EB office. This EB office module calculates the data and sends it to the customer along with the due date. The customer also gets details of the bill on his mobile phone through which he can pay the bill. If the customer fails to pay the bill the automated system, cut OFF the customer's supply and the restoration takes place only after the bill is cleared. Even though there are new modern methods of communication of billing data, the use of existing power line seems to be the most economically efficient.

REFERENCES

1. IEEE International Conference on Innovations in Green Energy and Healthcare Technologies(ICIGEHT'17) "Automatic Meter Reading of Electricity By Using Power Line Communication"
2. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 3, March 2013 "GSM Based Automatic Electricity Billing System"
3. International Research Journal of Engineering and Technology (IRJET) Volume: 02 Issue: 03 | June-2015 "Automated EB Billing Using GSM And AD-HOC Wireless Routing"
4. Vol-3 Issue-3 2017 IJARIE- "Automated E-Billing and Supply Control using Power Line Communication"

5. *International Journal of Computer Applications (0975 – 8887) Volume 45– No.7, May 2012 44*
“Automated EB Billing and Supply Control using Power Line Communication”
6. *International Journal of Electronics Communication and Computer Engineering Volume 4, Issue (2)*
REACT-2013“Powerline Communication Based on Energy Meter Automation”