



# **Viability of Power Line Communication for Electricity Billing**

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**ABSTRACT:** Today every aspect of life automatic is required. To reduce the work, we have designed automatic meter reading using power line communication; this automatic meter reading will overcome the current method used for electricity billing. AMR is a automatic power measuring device. By using AMR we can eliminate the need for electricity board meter readers. This system automatically collects the energy consumed by the consumer and send to electricity board section through the power line. AMR also disconnect meter either load cross the payment period.

**KEYWORDS:** Microcontrollers, LCD with driver, Crystal oscillator, USART, Max232, Power line modem, Regulated Power Supply.

## **I.INTRODUCTION**

Power-line communication (PLC) carries data on a conductor and electric power transmission or electric power distribution to consumers takes place simultaneously. It is also known as power-line carrier, power-line digital subscriber line (PDSL) and other mains communication are power-line telecommunications, or power-line networking (PLN). It solves the problem that still faced in existing system like need for efficiency, accuracy, delayed work and unavailability of meter reading employees etc... It is an efficient and effective way to save energy in an economical way. For billing process automatic meter reading system is a technology which is used to access the data from energy metering devices and transfer it to a central station. Automatic meter reading system helps the customer and energy provider to access the accurate and updated data from the meters. AMR system can fetch energy consumption from the consumer house hourly, monthly according to the request.

## **II.EXISTING SYSTEM**

### **2.1 GSM Based AMRS:**

Here, the main difference in GSM based AMRs and the existing system is the Automated Meter Reading Module and the Communication Module. The GSM based systems consider the GSM Network for Communication purposes. GSM provides a global coverage across countries thus enabling communication to every corner without the need to implement a new communication infrastructure for this purpose. GSM technology also provides services like SMS (short message service) and GPRS (general packet radio service) for requesting and retrieving reading from individual houses. GSM network is a more efficient, reliable and secure communication standard that is being widely used for more than several years without any technical issues. Existing system energy meter readers have to visit the consumer's house to know how much energy is consumed by the consumer. The meter reading for electricity consumption and billing is done by human operators. This system has certain problems - time, error, cost .To overcome such problems AMR system is implemented. The AMR system using GSM Network is now existed.

### **2.2 Zigbee Based AMRs:**

Zigbee is a collection of communication protocol using low power digital radios. The range of an average Zigbee is limited to 10-100 meters, but for more extension we can use mesh network of Zigbee devices. It is mostly employed in wireless control and monitoring applications due to its low cost. In the case of low duty cycle and low power consumption is an important consideration Zigbee was designed to provide high data applications. Zigbee digital power meter was installed in every consumer side and an electricity e-billing system at the electricity board section. The



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Zigbee digital power meter is a single phase digital kWh power meter. In Zigbee AMRs consist of an embedded Zigbee modem that sends the power usage back to the energy provider according to the information. At the electricity provider side an electricity billing system is used to manage all received meter reading after receiving compute the billing cost, and update the data base after that published billing notification to its respective consumer through wireless.

### 2.3 AMRS Using SCADA System:

The control purpose of remote equipments, SCADA (Supervisory Control and Data Acquisition) operating with coded signals over communication. It is a category of software application program for process control, gathering of data from remote locations in order to control equipments. The control system may be combined with a data acquisition system by adding the use of coded signals. It is a type of industrial control system. Industrial control systems is a computer based system that monitor and control industrial process. Most control actions are performed automatically by RTU (remote terminal unit), PLCs (programmable logic controllers) and IEDs (intelligent electronic devices) transferring it back to the central site, necessary analysis and control and then displaying that information on a number of operator screens or displays. A system using SCADA isolates and precisely locates faults and centralized monitoring and control to manage multiple facilities from a single location and remote software administration for better control is possible.

### 2.4 AMRS using WiMAX Technology:

WiMAX (Worldwide Interoperability for Microwave Access) is a wireless communications standard designed for providing 30 to 40 megabit-per-second data rates. WiMAX supports mobile, nomadic and fixed wireless applications. WiMAX brings with it the ability to transmit over far greater distances and to handle much more data. The reading unit identifies the disk rotation of the energy meter and the data is stored in a microcontroller. So there is no need to change the current analog energy meter. An external module is added with the current energy meter. In the communication unit WiMAX transceiver is used for wireless communication between meter end and the server

## III. PROPOSED SYSTEM

The meter reading data is sent by the home unit to the EB office through power lines. The electricity consumption and automatic billing through power line consists of main two sections:

- **Customer Section.**
- **Vendor Section.**

The components of the system are:

- Power Supply
- AVR ATMEGA32 Microcontroller
- Digital energy meter
- Interfacing units

### 3.1 WORKING

The regulated power supply provides the required power to each component is to be needed. The digital pulses from the energy meter are given to the microcontroller. The calculation of energy consumed by the consumer was take place digitally. For example: every 10 pulse the micro controller receives it and increases the number of units consumed by the consumer which was programmed in the EEPROM. This is then displayed in LCD.

### POWER SUPPLY

Power supply units (PSU) form an essential part of electronics equipment. A power supply unit is a device which provide the required current to the circuit. The following units form the backbone of power supply: - Transformer, Full wave bridge rectifier, Filter circuit, Voltage regulator. Transformer is used to step down the high AC voltage to a low voltage. Electronic circuit can never work with ACs, so this AC voltage should be converted into DC. AC voltage is converted to DC using a rectifier circuit. Input capacitor is required to minimize any ripple on input applied to regulator chip. Output capacitor is required to suppress any spike in fixed output voltage. The voltage regulator is to provide a stable dc voltage for powering other electronic circuits. The +5V regulated power is supplied from the output of power supply system.

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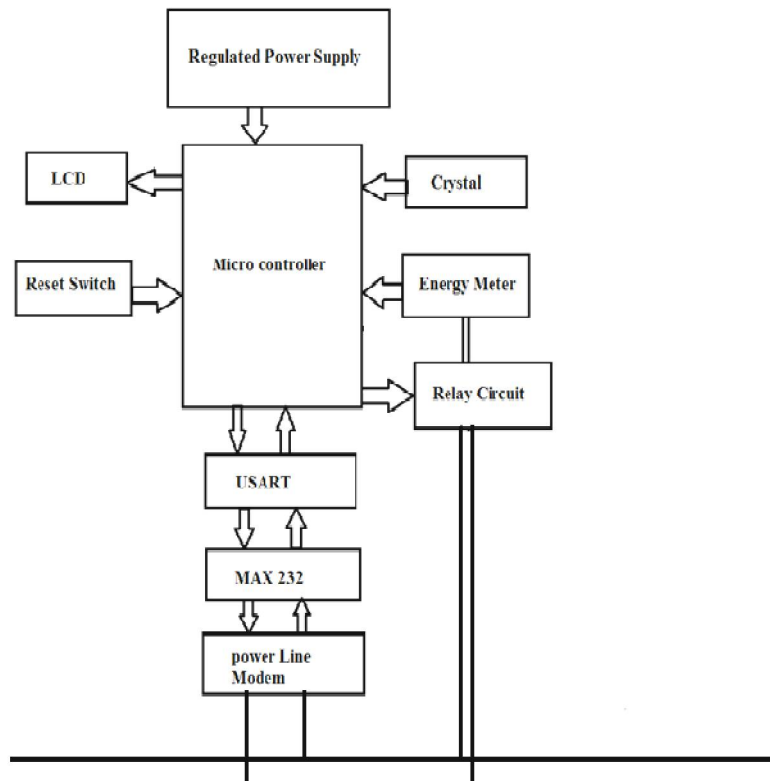


Fig. 1 Customer section

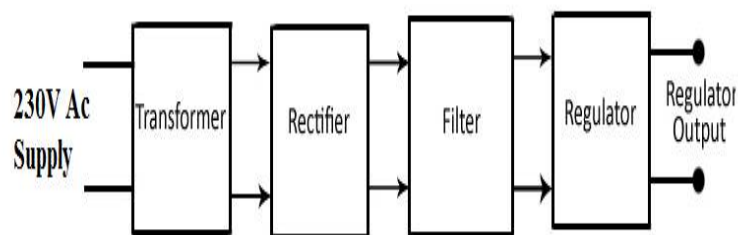


Fig. 2 Power supply block diagram

## ATMEGA32 MICROCONTROLLER

- Atmel AVR Microcontrollers.
- Atmega32 is based on enhanced RISC architecture.
- 40-Pin 16MHz 32kb 8-bit Microcontroller
- Easy-to-understand-operation,
- Very much high popularity.
- Ability to simplify digital circuit.



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## **ENERGY METER**

The electrical energy consumed by the consumers measured by using Watt hour meter or energy meter. Basic unit of power is watts. If we use one kilowatt in one hour it is considered as one unit of energy consumed. The Energy meter measures the instantaneous voltage and current then calculate its product and gives instantaneous power. These may be single or three phase meters depending on the supply utilized. It can be connected between line and load for small service measurements like domestic customers. Current transformers are used to isolate energy meters from higher currents in case of larger loads.

## **LCD**

A liquid-crystal display is a flat panel display and also called electronic visual display or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators and telephones. The cathode ray tube displays in most applications.

## **RESET**

Reset is used for make the microcontroller into a known condition. In practically sometimes microcontroller can behave inaccurately under certain undesirable conditions. In order to continue its proper functioning it has to be reset, i.e., all registers would be started from its initial position. Reset is not only used when microcontroller doesn't behave the way we want it to, it is also used for loading the program to the microcontroller.

## **INTERFACING UNITS**

It is an IC that converts signals from an RS-232 to TTL compatible digital logic circuits. USART is a piece of computer hardware that translates data between parallel and serial forms. USART is usually part of an integrated circuit. This is used for serial communications over a computer or peripheral device serial port.

## **POWER LINE MODEM**

Power-line communication (PLC) carries data on a conductor, which is also used simultaneously for AC electric power transmission or electric power distribution to consumers. It is also known as power-line carrier, power-line digital subscriber lines, power-line telecommunications, or power-line networking (PLN). A wide range of power-line communication technologies are needed for different applications, ranging from home automation to Internet access which is often called broadband over power lines (BPL).

Most PLC technologies limit themselves to one type of wires (such as premises wiring within a single building), but some can cross between two levels (for example, both the distribution network and premises wiring). Typically transformers prevent propagation of signal, which requires multiple technologies to form very large networks. Various data rates and frequencies are used in different situations.

## **CRYSTAL OSCILLATOR**

Crystal oscillator is an electronic circuit which converts the mechanical resonance property of piezoelectric material to an electrical signal. This frequency is commonly used to keep track of time, to provide a stable clock signal for microcontrollers. The most common type of piezoelectric resonator used is the quartz crystal. So oscillator circuits incorporating them became known as crystal oscillators

## **IV.VENDOR SECTION**

The vendor section consists of a power line modem and personal computer. The power line modem receives the number of units from the customer section through the power lines. The tariff sent to the micro controller through the same pair of MODEM. The number of units and bill amount will display on the LCD at the customer side.

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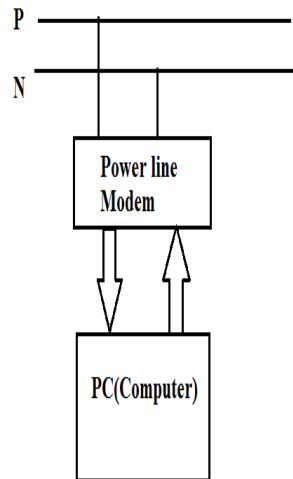


Fig. 3 Vendor section

If the customer does not pay the bill, supply can be disconnected by using relay circuit controlled by microcontroller. Relays are interfaced with microcontroller. The loads are connected through the relays and energy meter, such that loads are given a 230V AC power supply for their operation. This supply is given to operate the loads is disconnected when microcontroller receiving a command from vendor side through power line modem. The calculated amount in rupees proportional to EB meter data and the amount will be transmitted to the corresponding consumer home through power line and displayed in the LCD display placed in digital EB meter. The system model output is displayed in the Fig.4 and Fig5.



The image shows a screenshot of a login form. At the top, the word 'Login' is written in a large, bold, serif font. Below it, there are two input fields. The first is labeled 'User Name:' and contains the text 'EB Station Name'. The second is labeled 'Password:' and contains several small black squares representing masked characters. At the bottom of the form, there are two buttons: 'OK' on the left and 'Cancel' on the right.

Fig. 4 Login Form



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Transaction	
Data	0045
Customer ID	0001
Customer Name	Aditya
Category	COMMERCIAL
Opening Reading	0
Closing Reading	36
Total Amount	86

Trip On   Read   Clear   Exit

Fig. 5 Billing Form

The Fig4 shows the application for main login window of the PC in the substation, in that user name and password of the particular substation has to be entered. After that it will automatically open second window shown in the Fig.5. In that the Customer ID, Name and Category are selected. The corresponding energy consumed will be displayed in the screen and also displays amount proportional to the power consumption. The whole system is checked and results are taken for single user model only.

## VI.CONCLUSION

The aim of this work was to design an Automatic Energy Meter reading system based on power line communication. Here the automatic meter which reads the energy that consumed by the consumer and send to the electricity board section through the power line i.e., AMR system automatically transmits readings to the server through power lines. Now a day's many problems occur like no accurate billing, erroneous reading, manual labour and time consuming to avoid this entire difficult task. Automatic Energy Meter Reading system is implemented. It provides meter accuracy & reduced meter maintenance expenses. It provides some features of Remotely Connect / Disconnection of Power supply through power line communication Meter. The system is entirely designed to work on single phase, but this can be further extended to work on 3 phase. Transmission distance for the designed power line modem is up to 300m, can be improved by upgrading the power line modem. There are new modern technologies of communication of billing data which is the most economical one and reasonably adaptable system, when compared to the other technologies. Hence this system proves very advantageous as well as efficient one which might become the bench mark in the history of automation.

## REFERENCES

- [1]. Alauddin Al-Omary, Wael EL-Medany and SufyanAllrhayim, " Design and implementation of Secure Low Cost AMR System using GPRS Technology" 2011 International Conference Telecommunication Technology and Applications Proc of CSIT vol.5(2011)& (2011) IACSIT Press, Singapore.
- [2]. H.G. Rodney Tan, C. H. Lee and V. H. Mok, "Automatic Power Meter Reading System Using GSM Network" IPEC 2007,IPEC international power engineering conference, PP. 465 – 469, Dec 3-6, 2007.
- [3]. Bharat GSM Based Automatic Meter Reading System Using ARM Controller Kulkarni Associate Professor, P.V.P.I.T. Budhgaon ,International Journal of Emerging Technology and Advanced Engineering ISSN 2250-2459, Volume 2, Issue 5, May 2012.
- [4]. Satish Palaniappan SSNCE, Raghul Asokan SSNCE, Srinivas Bharathwaj SSNCE, Sujaudeen N Assistant Professor, CSE SSNCE, "Automated Meter Reading System - A Study" International Journal of Computer Applications (0975 – 8887) Volume 116 – No. 18, April 2015 39.
- [5]. Low cost E-Billing and Supply control using Power Line Communication Priyanka R Daware 1, S.S.Patil 2.International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 02 Issue: 03 | June-2015.