

# Automatic Meter Reading for Electricity Consumption and Billing System using Plcc

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## Abstract:

Electricity is required to measure power consumption. A Conventional system requires an individual and agent to physically come and take down the readings and report to household or office the amount one must pay. This process is very length and erroneous. So there is increased demand for Automatic Meter Reading (AMR) systems which collect meter readings electronically, and its application is expanding over industrial, commercial and utility environment. The main objective of the project is focused on the application of PLCC (Power Line Carrier Communication). The important advantage 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 corresponding to the status. Also the Customers can pay their bills at home through the RFID reader. The automated EB billing procedure fulfills a set of needs for the user and the EB workers.

**Keywords:** AMR, Power Line Carrier Communication, controller, RFID reader

## I. INTRODUCTION

Electricity is the building block for the development of any nation. It directly affects the economic growth of the country. So it becomes necessary to monitor and control usage of electricity. As the billing is done manually the error probability and manipulations while observing will be more. Drawbacks of the present system can be eliminated and efficiency of the system can be improved through automation. A system can be developed which will monitor the energy consumption of subscriber. The system should also be able to communicate with central authority through the power line. Thus electricity theft

detection system has become a necessity for most energy suppliers. The Powerline communication has many services on the data transfer via power line without using extra cables. Remote meter reading system is an important application in this regard due to every user connected to each other and central station through the power line. It is a technique to facilitate remote energy consumption reading. Illegal usage of electricity may indirectly affect the economic state of a country negatively [1]. In our world, many thesauri are taking place, even though the existing electricity consumption process seems in India to be very ancient 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 [2]. In this proposed system, the meter readings in the form of digital data are transferred from the customer end to the EB office through power line. In this system, billing and so the control of the system is fully automated when a customer fails to pay his bill within a given period of time the supply automatically gets cut off to his house and the restoration is done. In the existing system, the readings are taken using an employee working at EB office. This system has come some disadvantages like erroneous readings, difficult manipulation, manual labor and time consuming [3]. Using electric power lines as a signal transmission medium is possible as every building and home is already equipped with the power line and connected to the power grid. For providing high-speed network access points the Power Line Carrier (PLC) systems use the existing AC (Alternating Current) electrical wiring as the network medium. In many cases, construct a PLC network using an existing AC electrical wiring is simple than other networking systems and relatively economical as well. Automated Meter Reading (AMR) is one of the most important applications of Power Line Carrier (PLC). If a PLC-based AMR is set in a power delivery system

adetection for Non-Technical loss can be easily deployed [4].

## **II. LITERATURE SURVEY**

The digital meter reading was automatically noted by the Automated Meter Reading( AMR). The data sent through the Power Line Carrier(PLC). It provides advantages in measuring and saves the time and it has the better interfaces for the user and better analysis of digital data.Depends upon the data type being measured and technologies being used for data transfer technologies theAutomated Meter Reading(AMR) has various types. Automated Meter Reading (AMR) is the good technology of measuring, collecting and analyzing the data of large networks like electricity transmission and distribution of the network.

The first ac transmission line installed in 1886.It was very necessary to measure the electricity consumed by the consumer and they must pay for the electricity consumption. The Watt-Hour meter used at that time for, measuring the electricity consumed by the consumer. We know that the traditional meter reading device used in many places. It has more disadvantages that we will mention in later. We are going to find a newsystem which provides automatic reading, safety, accuracy and it also consumes less time for the process[5].

## **III. EXISTING SYSTEM**

- A. The energy meter reader goes to every home and takes the reading manually then issues the bill. This requires huge number of labors and long working hours for billing.
- B. The readings of the meter is done manually that leads to obvious error and wastage of time and resource.
- C. Consumer is not aware of the costs and service consumption until the statement charges are received.
- D. The employee of EB office have to personally visit the customer's house and cut off the power supply, in case of any failure in bill payment.
- E. Eventhough automatic meter reading(AMR) is a low data application, it requires both high reliability and low computational complexity.

## **IV. PROPOSED SYSTEM**

- A. In our project, we are going to implement a PLCC based reliable and efficient power metering system for energy management and control.
- B. The concept of power line communication is used for the transfer of data between consumer

and utility via existing AC power line as a medium.

- C. Power metering system will monitor the consumed power in particular home and transmitted via power line carrier communication.
- D. The bill payment section will take place in the home itself. RFID reader will detect the smart card and the bill amount was paid through that card.
- E. It gives switching ON/OFFfacility to the user which is very useful based on the signal sends to it from the controller corresponding to the status of bill payment.

## **DESCRIPTION**

### **A. POWER SUPPLY:**

The power supply section is a essential one.A power supply is a device that providess electric power to an electrical load.It should deliver constant output regulated power supply to 5volts DC power supply and that is given to the microcontroller.

### **B. TRANSFORMER:**

A transformer that transfers electrical energy from one circuit to another circuit through the conductors which are inductively coupled,i.e the transformer's coils or windings. Transformer is used to step down the voltage which is suitable for the low voltage components. The transformer used here is a 230/ (5V-0-5V) step down transformer. The primary and secondary coils of the transformer is used to step down the voltage,so that the secondary coil of the transformer is designed to contain less number of turns. The power supply of AC voltage arrives at 230v.Step down electrical device is meant in such how that the input is 230V and output of 5V.Another factor is that electronic circuits operate in DC wherever as accessible output of electrical device is AC of 5V.So the rectifier circuit is employed to convert AC to DC.

### **C. ARDUINO-UNO CONTROLLER:**

Arduino Uno is a microcontroller based on the Atmega 328P. It has digital input/output pins of 14,6 analog inputs, a 16 MHz quartz crystal, a USB connection, an ICSP header, a power jack and a reset button. It contains all required support to help the microcontroller.To start the Arduino simply connect it to a computer with a USB cable or power it with an AC-to-DC.

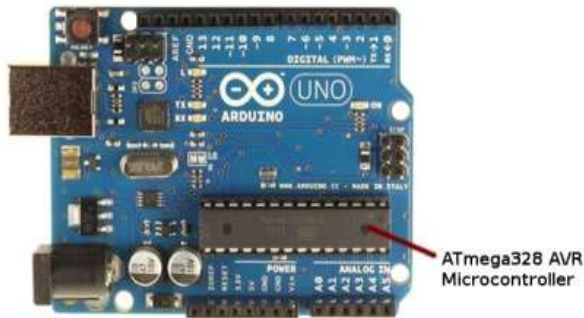


Figure 1: Arduino-Uno Controller.

#### D. PLCC MODEM:

Power line Carrier Communication Modem is used to send and receive serial data over existing AC main power lines of the building. The PLCC modem is ready to use circuit module. It has a baud rate of 9600 which uses bi-directional data communication. Because of its small size, it can be integrated. It has high immunity to electrical noise which presents in the power line and built-in error checking so it will never give a corrupted data. PLCC can directly interface with the microcontroller device.



Figure 2: Power Line Carrier Communication Modem.

#### E. USB CABLE:

USB port in the Arduino is used to simulate a serial port. So we have to use a USB cable to connect the Arduino USB port to computer USB port.



Figure 3: USB Cable.

#### F. RFID READER:

A Radio frequency identification reader (RFID READER) is a device used to collect the information from an RF ID tag, which is used to identify the individual objects by using radio waves. To transfer a data from the tag to reader radio waves are used. RFID is a technology similar in theory to barcodes.



Figure 4: RFID Reader

#### G. LCD DISPLAY:

A Liquid crystal display uses the light-modulating properties of liquid crystals and it is a flat-panel display. Liquid crystals emit the light not directly, instead of using a reflector to produce images in colour or black and white. It shows the information of an amount of electricity consumption and bill with respect to the power consumed by the customer.



Figure 5: LCD Display.

#### H. CURRENT SENSOR:

A Current Sensor that detects current in a electrical cable and generates an electrical signal proportional to that current. It could generate an analog voltage or current even a digital output. The measured current in an ammeter is displayed using the generated signal, or can be stored for further analysis.



Figure 6: Current Sensor

I. VOLTAGE SENSOR:

The Voltage Sensor that measure the potential between the two points of an electrical circuit and converts into a physical signal proportional to that measured voltage. Connections + and - are electrical protection ports through which the sensor is connected to the circuit.



Figure 7: Voltage Sensor.

V. BLOCK DIAGRAM

A. HOME SECTION:

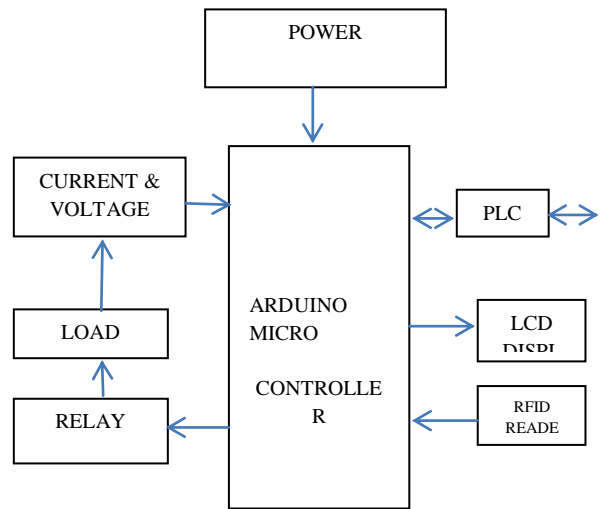


Figure 9: Home Section in Automatic Meter Reading For Electricity Consumption and Billing System Using PLCC.

B. EB SECTION:

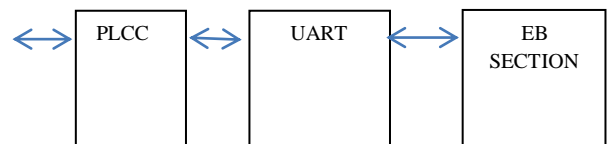


Figure 10: EB Section in Automatic Meter Reading For Electricity Consumption and Billing System Using PLCC.

VI. WORKING PRINCIPLE

- A. Home Section
- B. EB Section

A. HOME SECTION:

Here embedded c coding dumped into Arduino controller, which has the conditions and terms. There are two sensors connected to the Arduino controller. The sensors are current and voltage sensors and they senses the current passing through the meter and voltage created by itself. The controller connects with the Power supply, Relay, RF ID Reader, PLC and LCD display. The RF ID

reader reads the signal when the RF ID tag scanned by it and that time it transmits the signal to controller. Arduino receives the signal from RF ID reader and makes the LCD display to display as “MONEY PAID” by transmitting signal to the LCD display unit. When the payment was not paid by the consumer that time it will shut down the power supply by switching off the relay unit. This process maintained and controlled by the Arduino controller.

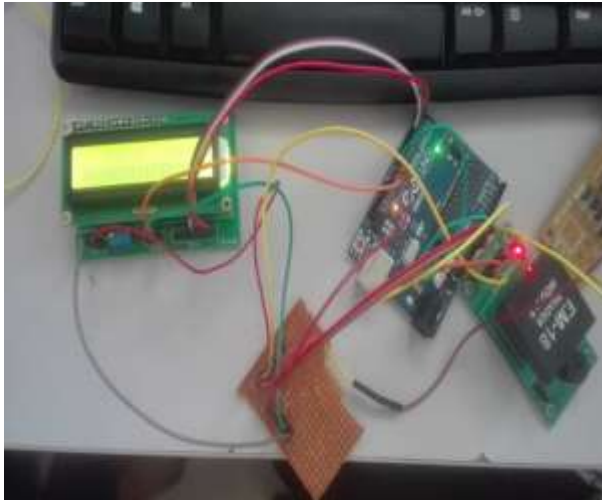


Figure 11: Home section with LCD display

#### **A. EB SECTION:**

The arduino controller in Home section connected with a PLCC. PLCC has the functions of both transmitting and receiving data as well as electricity. That receives data and signal from Arduino and transmits it to the PC in EB Section by Universal Asynchronous Transmitter/Receiver communication.

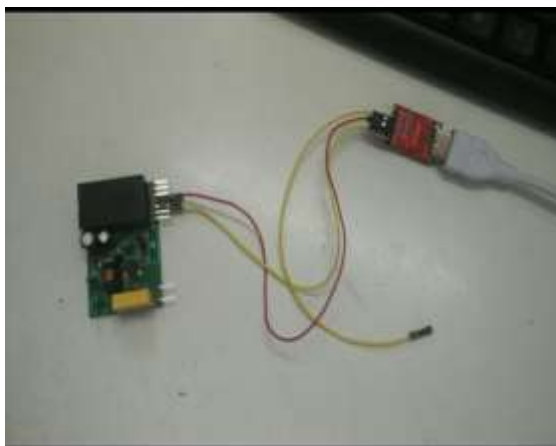


Figure 12: EB unit with PC section

## **VII. APPLICATIONS**

### **A. TRANSMISSION & DISTRIBUTION NETWORK:**

For the purpose of transmitting the information at fast rate in Transmission and Distribution Network

### **B. HOME CONTROL & AUTOMATION:**

This technology provides Power Management and Energy Conservation.

### **C. ENTERTAINMENT:**

It transmitting and receiving the multimedia content.

### **D. TELECOMMUNICATION:**

Telephonic Communication, Audio communication and video Communication can be easily done by plcc.

### **E. SECURITY SYSTEMS:**

PLCC was efficiently used in Surveillance camera for monitoring the home and business area.

### **F. AUTOMATIC METER READING:**

AMR used for sending and receiving data between home and EB sections.

## **VIII. ADVANTAGES**

- A. Low-cost, fast and efficient data collection.
- B. Reduced meter reading costs.
- C. Ability to access difficult-to-read meters.
- D. Improved customer service.
- E. Implementation of real-time pricing.
- F. Reduced man-power.
- G. Accurate readings.

## **IX. CONCLUSION**

The designed automated system is a smart automated process instead of manual work. hence, meter accuracy is increased and meter maintenance expenses also reduced. This proposed automated system consists of two sections. One at Electricity board office that includes office section which has a PC with its back end connected to a database. The other section is the customer home section which is present at the home this section is used to read the amount of power consumed by the customer and the data of information is sent to the PC in the EB office. This EB office section calculates the bill and sends the amount of bill to the consumers through the PLCC. Also, it allows the user to get updated regarding the details of power used in his house. The proposed system uses the existing power line. because, it seems to be the most economical one and adaptable system, compared to the other methodologies. Thus this system proves to be very advantageous as precise consumption information can be easily obtained. Clear and accurate billing is done, without error.

## **X. ACKNOWLEDGEMENT**

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