

# Automatic Meter Reading of Electricity Power Consumption by Using Power Line Communication

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**Abstract:** As in every where automation is required to reduce the work so we decided to implement to automatic meter reading using power line communication. AMR is the modern Power measuring device .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 saving as well as it has a better user interface and digital data analysis .Data is send over existing carrier that's reduces the complexity and cost of system.[1][2]

**Key word:** Power Line Communication Modem (Sunrom), Digital Energy Meter ADE7751.

## 1. INTRODUCTION

Power is the soul of world which is related to the electricity and “electricity” is the word which now rules the world. So, proper utilization of this commodity is of immense important to us. Hence, it is necessary to measure power consumption. Normally, large scale industries consist of various departments like production, storage, package, administration, transportation situated away from each other. For such industries, it is necessary to maintain record of daily power consumed by every department to keep check on excess power consumed.[3]

A power line carrier (PLC) communication system operating on a conventional three wire (Hot (H), Neutral (N) and Ground (G) wires) power line uses more than one of the several RF transmission lines that are defined by the three wire power line to improve communication between units of the PLC system. According to a first embodiment a PLC system transmitter sends out of phase RF signals across the H and G wires and across the N and G power wires to the PLC system receiver, which receives and combines both of the out of phase transmissions, and so even if one of these paths is severely attenuated, the other path can deliver a sufficiently strong RF signal to the receiver for effective communications. According to another embodiment three different pairs of the H, N and G wires of the power line are selected in sequence for transmission of the PLC system RF and the pair that results in the best communication

between a system transmitter and receiver is used for continuing communication. Also included is a PLC telephone extension system for which there is full duplex communication between each of the extension telephones of the system at different locations in the premises and the premises telephone line.[2][3]

## 2. BLOCK DIAGRAM

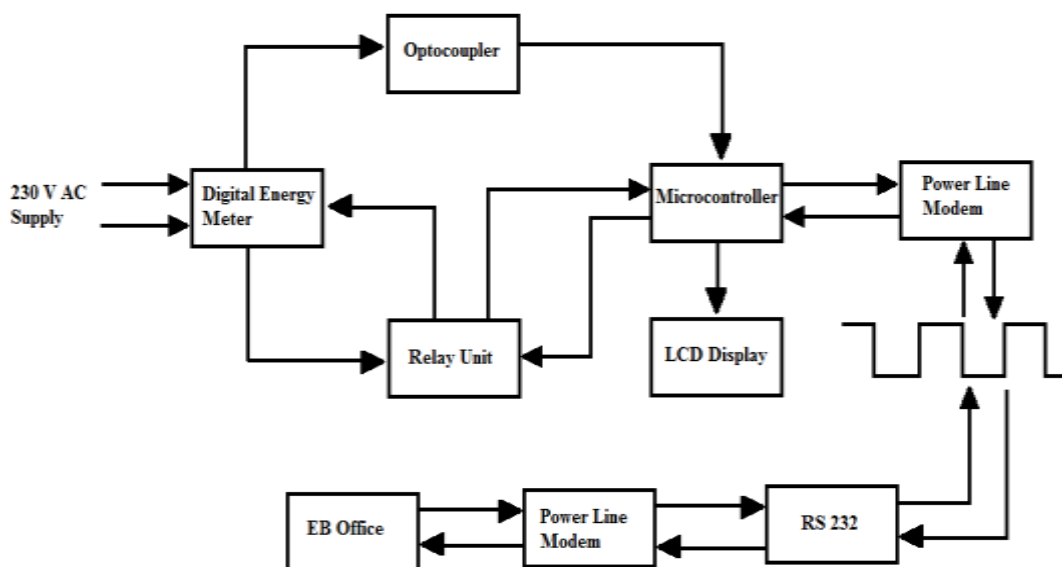


Figure 1. Block diagram of AMR

## 2.1 WORKING:

### 1. Power supply:

- In the circuit using IC 7805, we can get +5V DC supply.
- In the circuit, +5V DC supply is required for :
  - ATMEGA8
  - LCD Display
  - Power line communication

### 2. Digital energy meter

For the project we used ADE7751 this type of energy meter. It is more advantages like high-accuracy, fault-tolerant electrical energy measurement IC that is intended for use with 2-wire system. Meter fed by electric supply but operated by electronically. Its design is useful for interfacing all data with power line communication modem.

### 3. Optocoupler

This IC is used to provide electrical isolation between two circuits, one part of the circuit is connected to the IR LED and the other to Photo-transistor. The digital signal given to the IR LED will be reflected on the transistor but there will be no hard electrical connection between the two. This comes in very handy when you are trying to isolate a noisy signal from your digital electronics, so if you are looking for an IC to provide optical isolation in your circuit design then this IC might be the right choice for you.

### 4. Relay and Relay driver

Relay use for getting on-off command from electricity office. If ON command given by office then coil will energized and attract the plate, switch on the supply, if OFF command given by office then coil discharge, the plate will be repel and turn off the supply.

### 5. Microcontroller

The microcontroller which we have used is ATmega8-p. Flash, EEPROM, and SRAM are all integrated onto a single chip, removing the need for external memory in most application. Some device have a parallel external bus option to allow adding additional data memory or memory-mapped device. Almost all device have serial interface, which can be used to connect larger serial EEPROMs or flash chip.

### 6. LCD Display-16x2

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters animations.

### 7. PLC Modem

For sending and receiving serial data over existing line used power line communication or carrier modem. It has given safety data over power line irrespective of noise and gives out the without corrupted data. PLC modem use in consumer section for transmitting data as well as used Server section for receiving data.

## 2.2 SYSTEM REQUIREMENT ANALYSIS

### • Energy meter

An electricity meter or energy meter is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device. Electricity meters are typically calibrated in billing units, the most common one being the kilowatt hour [kWh]. Periodic readings of electricity meters establish billing cycles and energy used during a cycle. Electronic meters display the energy used on an LCD or LED display, and some can also transmit readings to remote places. In addition to measuring energy used, electronic meters can also record other parameters of the load and supply such as instantaneous and maximum rate of usage demands, voltages, power factor and reactive power used etc. They can also support time-of-day billing, for example, recording the amount of energy used during on-peak and off-peak hours. For the energy meter used in the project, 3200 led blinking corresponds to 1 unit of energy consumption.

### • Energy measuring unit

The energy measuring unit consists of standard calibrated energy meter and a light dependent resistor (LDR). The IR LDR is placed in the top of the energy meter to sense the blinking of the LED in the energy meter. Digital energy meter works on the basis of the flash made by the LED. This flash is detected using an LDR. It sense the blinking of energy meter led and compare with the reference voltage with help of a comparator. If the

output of comparator is high then the number of units counting will be incremented in the microcontroller. The output of comparator is given directly to a pulse counter in atmega16a. It counts the number of pulses. It is proportional to energy consumed.[4][5]

• **Consumer side unit (CSU) operation**

The microcontroller receives the measured quantity as analog data from the energy meter port which is in watt-hour meters a potential and current quantities .The microcontroller is programmed to analysis this quantities then it display the reading in the LCD screen .

When the server wants to collect the reading from the meter, it sends a message to the meter which receive it throw the antenna and the PLC modem connected with it. This message call the meter to wake up and then it makes a data frame consisting of the meter’s information and sends it to the server which collect them and store them in the database . The data collection can be done at any time or periodically such as hourly, daily, weekly or monthly.

• **Server side unit (SSU) operation**

First, the SSU send a waking message to the CSU to tell it to wake up nd start preparing data. After the CSU response and send the data , the SSU collect this data , analysis it and make the computations needed , then it store them on the database of the company.

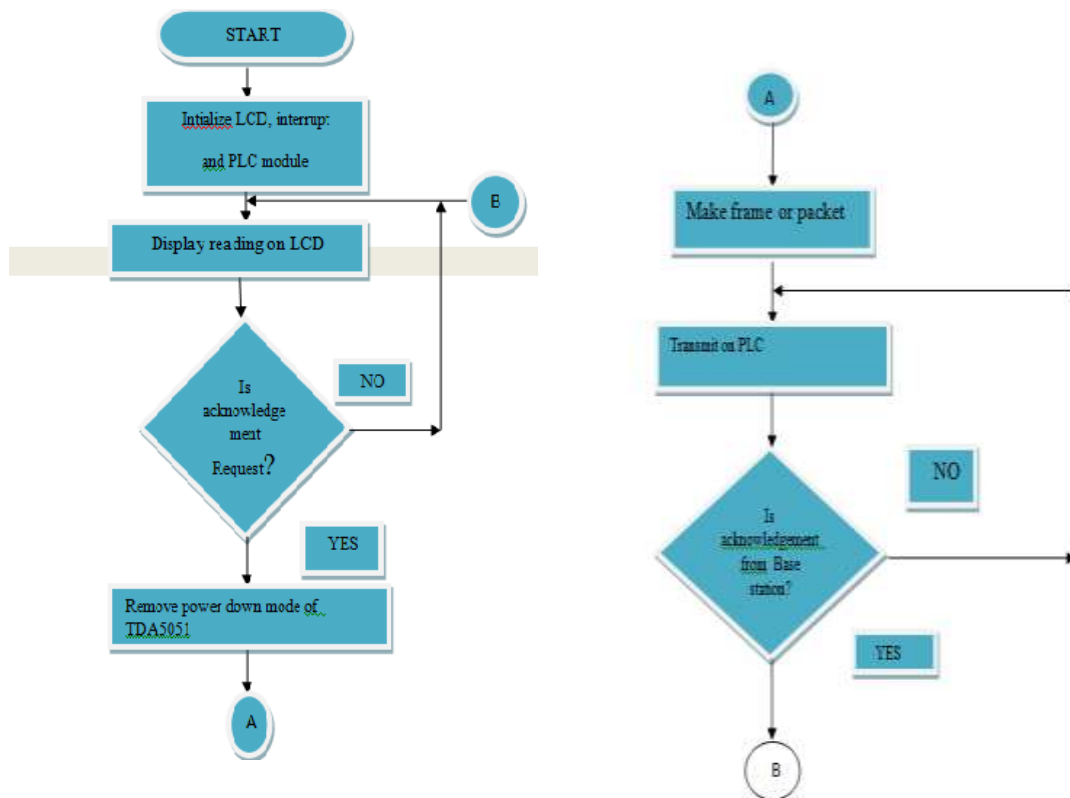
The SSU can reprogram the CSU and fully control it by sending connect/disconnect commands or applying remote energy management .This reprogramming and controlling processes is being done throw commands transferred thro the communication channel between the SSU and the CSU .

• **Power line Communication**

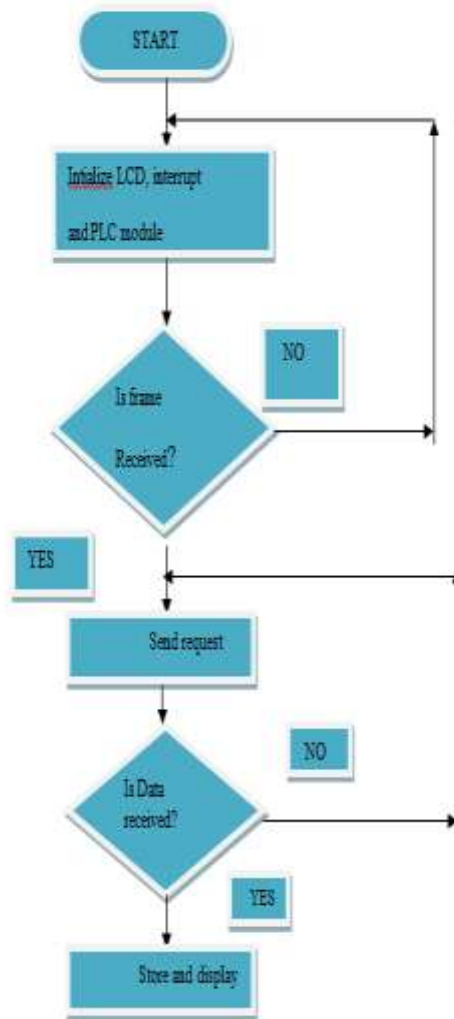
Power line carrier communications take place over the same lines that deliver electricity. This technique involves injecting a high frequency AC carrier onto the power line and modulating this carrier with data originating from the remote meter or central station.

Years of research, however, have not overcome the technical problems that preclude this medium from being a cost-effective solution over primary transmission lines. Power line carrier techniques may be used successfully and cost effectively for short distances; i.e., from a customer’s meter to a pole or surface-mounted transformer. It is very expensive to pass this data through a distribution transformer and onto the primary distribution lines and the resulting communications is slow due to the narrow bandwidth and mono-directional meaning data is transmitted from the meter to the company but the company cannot send data or control signals back to the meter or associated devices at the subscriber side.[6][7]

**3. FLOW CHART FOR CONSUMER SIDE**

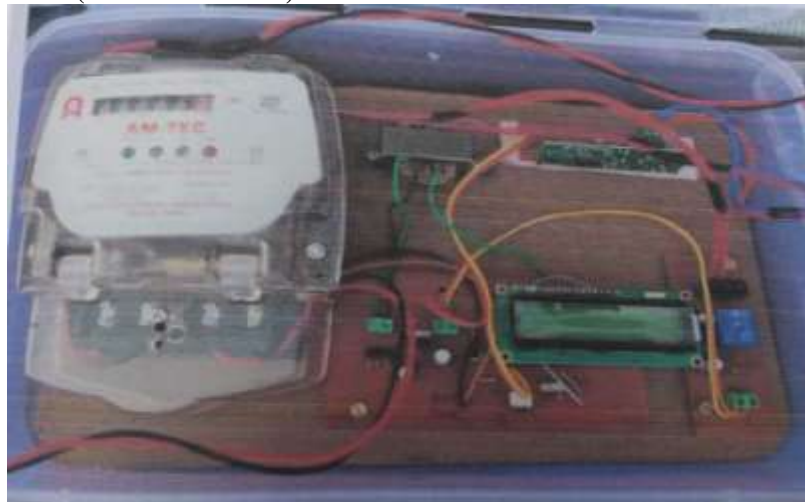


#### 4. FLOW CHART FOR UTILITY SIDE

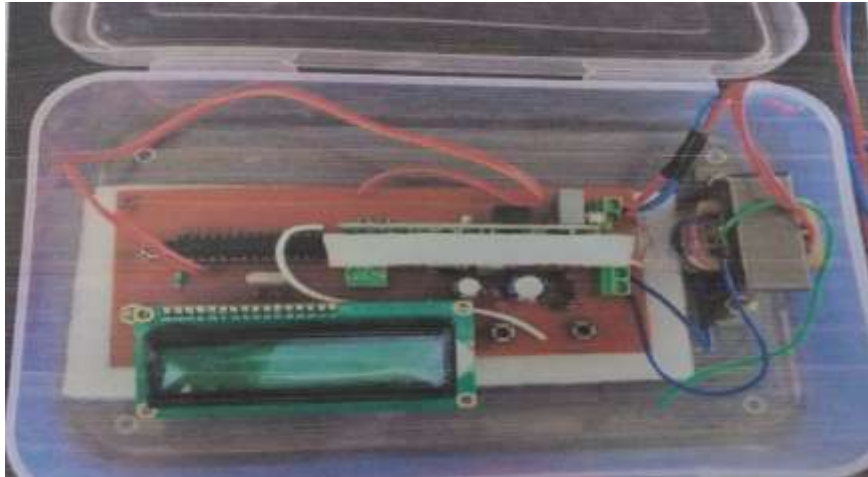


#### 5. HARDWARE RESULT

- Consumer section( Transmitter Side)



- **utility Section ( Receiver Side )**



- **Unit generate – Consumer Side**



- **Unit generate – Utility Side**





## 6. CONCLUSION

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 new system which provides automatic reading, safety, accuracy and it also consumes less time for the process

In conventional system require employee went to consumer's home and cut off the supply manually, but in our project electricity board can cut off the supply automatically. We provide one switch in electricity board by pressing this switch board can cut off the supply of consumer's house. Consumer's supply will in off position till consumer pay the bill.

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## REFERENCES

- 1] Sayali G. Deasi, Dr. B. T. Salokhe, Prof. A. S. Mali, "Global Industrial Process Monitoring Using RASPBERRY PI Controller", International Journal of Advance Technology in Engineering and Science, ISSN 2348-7550, Impact factor: 3.58, volume 5, issue 8, pp. 13-20, August 2017
- 2] Poonam Borle, Ankitha Saswadhar, Depali Hiwarkar, Rupali S Kali, "Automatic Meter Reading for Electricity", International Journal of Advanced Research, Volume-2, Issue 3, March 2013.
- 3] M V Aleyas, Nishin Antony, Sandeep T, Vishnu Balakrishnan "Automatic Meter Reading and Load Management Using Power Line Carrier Communication" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (An ISO 3297:2007 Certified Organization) Vol.3, Issue 5, May 2014
- 4] G.Sujatha, D. Murnali, R. Ramkishori "Automated EB Billing and Supply Control Using Power Line Communication" International Journal of Computer Application (0975-8887) Volume 45- No.7, May 2012
- 5] Namita.N.Jinde, Rashmi.K.Bhojane, Reetesh V.Golhar "Power line Communication Based On Energy Meter Reading Automation" International Journal of Electronics communication and Computer Engineering Volume 4, Issue (2) REACT-2013
- 6] Manali A. Hirave, Prof. A. S. Mali, Dr. B. T. Salokhe "Automatic Power factor Correction and Monitoring by Using PIC Microcontroller", International Journal of Advance Technology in Engineering and Science (ISSN 23487550), Impact factor 2.87, volume 05, issue 07, pp 358-364, July 2017.
- 7] Bhushan D. Sawarkar, Snehal S. Golait "A Review Proper on Automatic Meter Reading and Instant Billing" International Journal of Advanced Research in Computer and Communication Engineering Vol.4, Issue 1, January 2015
- 8] Pallavi M. Magdum, Prof. D. G. Chougule, Prof. A. S. Mali, "Distribution Substation Monitoring System Using Lab View", International Journal of Electronics Engineering, (ISSN: 0973-7383), volume 10, issue 1, pp 01-04, Jan 2018.