



Research Article

AUTOMATIC METER READING OF ELECTRICITY POWER CONSUMPTION BY USING POWER LINE COMMUNICATION

Ashwini B. Mane, A.S.Mali and Dr.B.T.Salokhe

Department of Electronics Engineering, Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Affiliated to Shivaji University, Kolhapur, Maharashtra, India

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ABSTRACT

Power is the spirit of world. It is relevant to the electricity and “electricity” is the word which now makes rule the world. So, proper utilization of this power is important to us. Hence, it is need of consumed power measurement. In conventional system, individual and agent to physically come and taking the reading and give report to electricity office. The goal of this system is to transmitting the unit consumed by consumer to the electricity office. Power Line Communication means transmitting voice or non-voice signal from existing main AC line. Power Line Communication uses the existing power line for transmitting data. For this system addition line is not required for transmitting data. This system also related to status of bill payment, if consumer pays the bill then electricity office gives ON command but if consumer fails to pay bill then electricity office gives the OFF command.

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INTRODUCTION

Electrical power has become indispensable to human survival and progress which leads to the enhancement of the people’s standard of life by the introduction of automation in to energy distribution and management. With the constant development in technology, the need of automated meter reading systems is also increasing. The technology of e-metering (Electronic Metering) has gone through rapid technological advancements and there is increased demand for a reliable and efficient Automatic Meter Reading (AMR) system.

The Traditional Method of taking reading of each energy meter is time consuming and costly and also one person is required for taking reading .some of energy meter located at poor accessibility area where take down reading is very difficult. The main purpose of this project is getting consumed meter reading by using existing line (power line). In this project, electricity consumed by consumer in local area is measured and transmitted consumed reading through existing power line to the electricity office. Due to this system minimize the man efforts and damages of energy meter .this system useful for electricity office for proper distribution and monitoring the consumed energy by consumer .monitoring done by giving ON-OFF command depend on bill statement.

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

***Corresponding author: Ashwini B. Mane**

Department of Electronics Engineering, Tatyasaheb Kore Institute of Engineering and Technology, Warananagar Affiliated to Shivaji University, Kolhapur, Maharashtra, India

Block Diagram

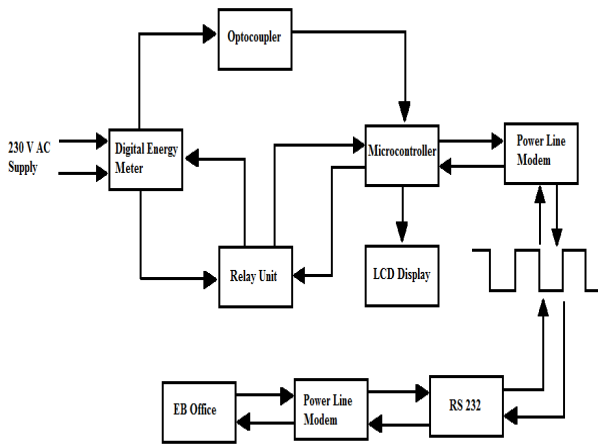


Figure 1 Block diagram of AMR

Block Diagram Explanation

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

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. It design is useful for interfacing all data with power line communication modem.

Optocoupler

- Gallium Arsenide Diode Infrared Source Optically Coupled to a Silicon npn Phototransistor.
- High Direct-Current Transfer Ratio
- Base Lead Provided for Conventional Transistor Biasing
- High-Voltage Electrical Isolation-1.5-kV, or 3.55-kV Rating
- Plastic Dual-In-Line Package
- High-Speed Switching: $t_r = 5 \mu s$, $t_f = 5 \mu s$ Typical
- Designed to be Interchangeable with General Instruments MCT2 and MCT2E

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.

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.

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.

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 place ,switch on the supply ,if OFF command given by office then coil discharge ,the plate will be repeal and turn off the supply.

System Description

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.

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.

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.

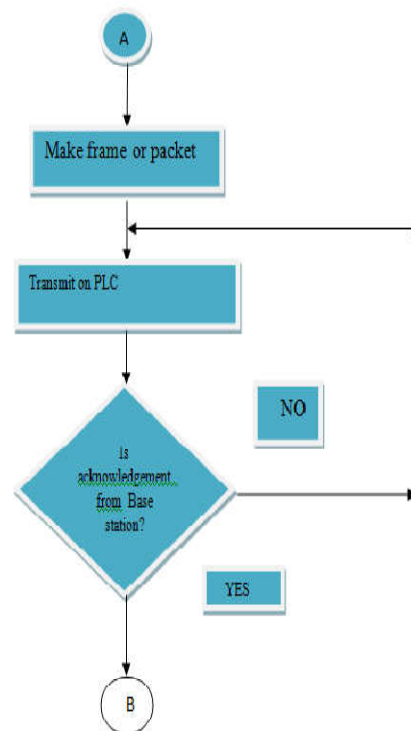
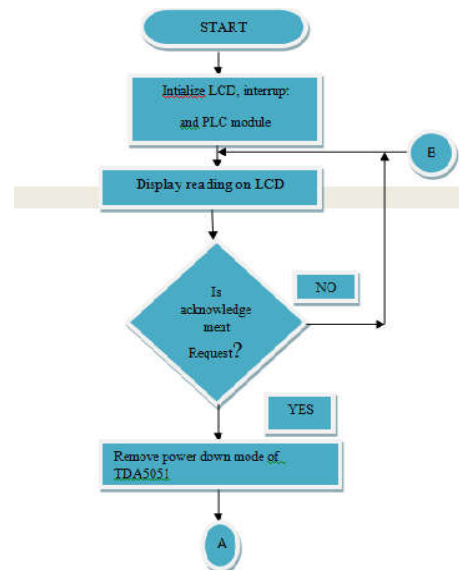
The SSU can reprogram the CSU and fully control it by sending connect/disconnect commands or applying remote energy management .This reprogramming and controlling processes is being done throw commands transferred throw the communication channel between the SSU and the CSU .

Power line Communication

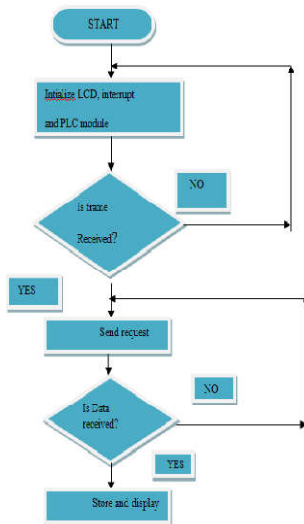
Power line carrier communications take place over the same lines that deliver electricity. This technique involves injecting a high frequency AC carrier onto the power line and modulating this carrier with data originating from the remote meter or central station.

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.

Flow Chart for Consumer Side



Flow Chart for Base Station



Advantages

- Remotely Connect / Disconnection of Power supply through PLCC Meter
- Ability to detect tamper events and outage occurrences
- System has no running cost for data acquisition.
- Reduction in manual meter reading costs.
- Reduction in late and estimated billing costs.
- Improved meter accuracy & Reduced meter maintenance expenses.

Future Scope

- The reading of customer premises will be sending to electricity office for further billing process
- Cost of one system is little high but if bunch of system will be produce in reduced cost.
- The present system implement for automatic reading only, further process it will give idea about power theft.

CONCLUSION

The proposed automatic billing system save the time and man effort fully automatic, gives the customer satisfaction, reduce complicity. Automatic meter reading of electricity using PLC modem is more advantages then GSM based system. If customer fails to pay bill then supply is cut OFF automatically. Thus this system proves to be very efficient, the one which might become the bench mark in the history of automation.

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