

ID Based Smart Energy Meter Using Power Line Carrier Communication

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Abstract

This paper illustrates an economical way to control energy meters using Power Line Carrier Communication (PLCC) and is controlled by the grid station. An ideal energy meter which is prepaid, have the ability of auto reading, and on load management. All users are restricted to use the limited load let's say 500 watts. Buzzer goes on and meter will shut down if user exceeds restricted load. On decreasing the load meter will restart. Energy meter will be shut down if user runs out of unit.

Key words— Power Line Carrier Communication (PLCC), Smart Energy Meter, Power Line Communication (PLC), ID Based Smart Energy Meter, PLC Module, KQ330 Module, Auto Meter Reading, Power Transmission Lines (PTL).

I. Introduction

Electric power system constitute the fundamental infrastructure of the society. Power system consist of machines that generate and consume electric power.

Power systems have lot of issues that needs to be solved with appropriate solution. One of the big issue that we addressed in this research paper is power theft and reducing the cost of metering.

This issue has solution in making a control mechanism which cannot be cheated and have the feature of auto reading and load management, and is controllable by the grid station.

II. Survey of Related Work

Using the electrical power line to send information is not a new idea. Sweden has been using its electrical power grids for telephone communication for many years. Further, electrical power lines have been used throughout the world for low frequency communication by electrical power industry for simple control function, using protocol such as X10 Home Automation. These proprietary protocol are low speed and are solely used for controlling consumer system, such as light, appliances or simple electronics.[1] We have used power lines to control energy meter from the grid station. Reception and transmission of data is carried out by using KQ330 [2] module which is interfaced with the microcontroller so that commands can be executed.

III. Research Question and Problem Statement

Our research question is that how can we control energy meters from centralized control unit using

power line communication and its impact on our energy system. The main problem is that the old metering system can easily be tempered and sometime the human metering has reading draw backs.

IV. Problem Solution

Meter reading problem are solved. Water And Power Development Authority (WAPDA) Pakistan can improve its economy.

Implementing this system time, money and electricity can be saved. No extra wiring is required with best signal security.

We can access energy meter by using ID based communication and thus controlling from the control station using PLCC.

PLCC means transmission of data on Power Lines. This is done by sending data at zero crossing of the power signal by using 125KHZ carrier signal and ASK modulation.

V. Methodology

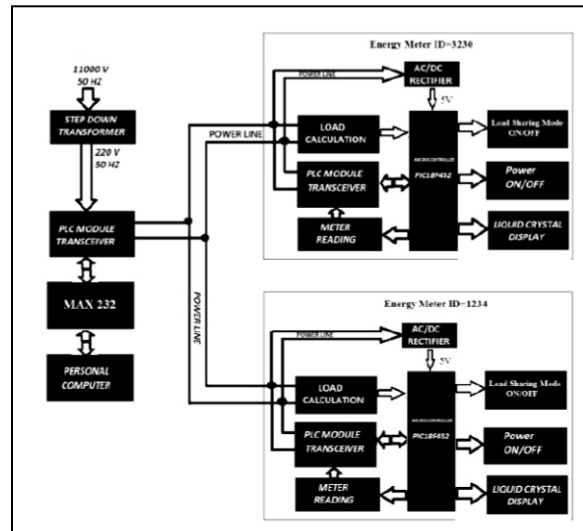


Fig 1. Block Diagram of ID Based Smart Energy Meter Using PLC

A. Controlling Energy Meter

Low voltage data received from the PC is impressed upon the high voltage using PLCC module. To stop high voltage flow into the control station coupling circuit is used. The modulated signal travels in the power lines until it encounters a demodulator via a coupler. The demodulated data is then analyzed by the

microcontroller and the appropriate command is sent. The Energy Meter Microcontroller is programmed in c language using PIC C compiler [3].

It is programmed such that it receives and sends data via serial communication through pin C6, C7. The data is analyzed and relevant operation is performed.

The value such as watt and unit allowed is saved in the Electrical Erasable Programmable read only memory (EEPROM).

B. Centralized Control Unit

A centralized control unit is used to control the consumer's meter as well as to get the value of load connected and unit update. In order to accomplish this task, we have made a hyper terminal in C# language and programmed it in such a way that it displays the number of unit, watt and meter id. We have certain command button on the hyper terminal that receive and transmit signal from the energy meter using serial port of the personal computer. We can switch on/off the load connected to energy meter.

C. Power Line Carrier Communication

The information signal is coupled on the power transmission line (PTL) using power line communication module. Information signal sent on the PTL are of high frequency. The transmission and receptions of information signal from PTL is done with help of PLC module. The PLC module has a built in coupling circuit and the function of coupling circuit is to couple the PLC module with the high power AC transmission lines. The capacitors of the coupling circuit combine with the inductance makes a high pass filter that suppresses the low frequency signal i.e.50 Hz. It also isolates the high voltage tension line and PLC module in order to avoid passing of high voltage in the base circuit. The figure of PLC module KQ330 is shown in fig.1.

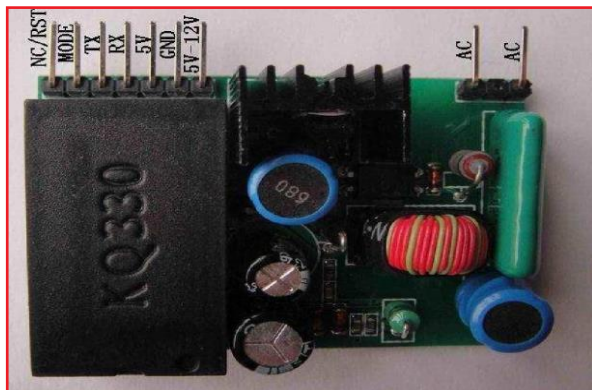


Fig 2. PLC Module KQ330

D. Information signal flow

Information signal moves to and fro in the PTL. The centralized control unit sends and receives data to and from the customer's energy meter. This Bidirectional data flow is carried out with the help of PLC module as shown in Fig. 2.

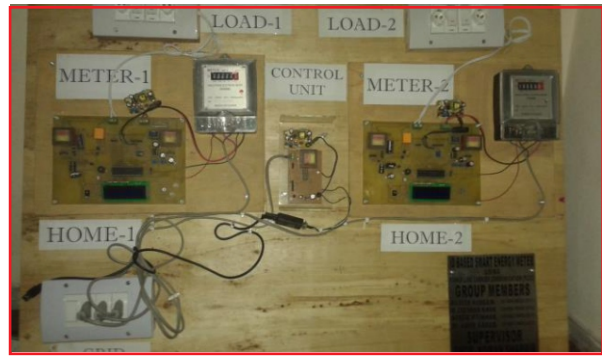


Fig 3. Implementation of ID Based Smart Energy Meter Using PLC

The Fig. 3 shows the implementation of research work at smaller scale. We have two meters named Meter 1 and Meter 2 installed in Home 1 and Home 2 respectively, both the energy meters are embedded with PLCC module. Between both is a control unit, which is connected to laptop acting as a control system. The entire system is connected to main power supply shown at the lower left corner of the picture. Both energy meter are connected to load1 and load 2 at the top of the picture. The command is sent by control unit to energy meter, executed by meter and results sent back to control unit.

VI. Conclusion

Keeping in view issue related to power system, we have to take decision that help to keep a better control of the energy flow in the power system. Employing "ID BASED SMART ENERGY METER USING PLCC" is one of the possible solution. Reading tempering problems are solved by this system. Water And Power Development Authority (WAPDA) Pakistan have many meter readers which are paid. Implementing this system, saving of time, electricity and money is possible. This system requires no extra wiring still ensures signal security.

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