Automatic Meter Reading System Using Lab View

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Abstract—The automatic meter reading system for measuring the amount of energy consumed by a load is implemented using LabVIEW Software. The LED pulses from a digital energy meter are bypassed via an optocoupler to the LabVIEW. The energy meter and LabVIEW are interfaced using DAQ module. The number of LED pulses is counted in LabVIEW and the instantaneous energy consumed by a 200 W bulb is calculated.

Keywords—Energy meter, NIcDAQ9172 Module, LabVIEW, MCT2E Optocoupler, number of pulses.

I. INTRODUCTION

An energy meter is used to measure the amount of energy consumed by a load. Here we measure the instantaneous value of energy consumed by the load with the help of LabVIEW Software. Energy meter is interfaced with LabVIEW by using NI cDAQ 9172 [1].

LabVIEW is a software package that is used for acquiring data and controlling the instrument as well.“.vi” is the extension that is used for code files which is an abbreviation for “Virtual Instrument”. DAQmx Base is a hardware driver topology which consists mainly of G-coded components along with a few register calls through NI Measurement Hardware DDK (Driver Development Kit) functions. It also provides platform independent of hardware access to numerous data acquisition devices.

This project aims at efficient management of energy in industries and Power Plants. The Power Plant is divided into different energy zones. Amount of energy consumed in each zone is taken to the LabVIEW Software through the setup explained in this paper. Threshold energy level is set for each zone. Algorithm can be developed so as to ring an alarm if the energy utilized by any zone exceeds the prescribed threshold value. Actions are then taken to limit the energy utilized by the zone within the prescribed limits, thus paving way for efficient energy management and reduction of energy wastage in Power Plants.

II. PROPOSED WORK

To implement this system, LabVIEW software package is used. An NI cDAQ 9172 module is used to interface the energy meter and LabVIEW.

It has two 32-bit counter/timer chips which are built into the chassis. Event counting, pulse-wave generation are some of the key operations performed by counter/timer.

The energy meter which generates the pulses as well as measure the energy consumed is used. A digital energy meter having an LED which blinks for a specific number of times to indicate the energy consumed is used. These pulses are fed to Labview Software which is programmed to count these pulses. Thus, the system reads these pulses and computes the energy consumed by a load over a period of time by using a formula that depicts the relation between number of pulses and energy consumed.

Fig1. Block Diagram

The pulses are taken to the DAQ module via an Optocoupler which provides electrical isolation between two parts of the circuit. It transfers light energy and not the electrical energy.

III. IMPLEMENTATION DETAILS

The digital energy meter used here has a calibration led which blinks proportionally to the energy consumed by the load. These pulses from a digital energy meter are then bypassed through an Optocoupler via DAQ to the Lab View. An MCT2E Optocoupler is used for electrical isolation between the electrical circuits here. It has a photo diode which emits light energy whenever pulses are transferred, that is whenever the led blinks. This light energy then falls on the phototransistor in the Optocoupler. The collector of phototransistor is connected to 10 V regulated DC supply via a 100 Ohms Resistor and the emitter is grounded. When light falls on the transistor, it gets switched ON and the 10 Volts supply is conducted to the DAQ module.
The DAQ module used here is NI cDAQ 9172. It acts as an interface between the energy meter and Lab view Software. The DAQ module and PC (Personal Computer) is connected by a cable. In Lab view, the pulses are counted by using NI-DAQ Assistant and a Comparator.

In the Lab view Software, Measurement I/O is taken, then NI DAQmx and thereafter selects DAQ Assist. For an analog input acquisition, go to a simple Analog Input and then select Voltage measurement. After that, the channels through which we want to acquire the voltage from are selected. After selecting the channel(s), the Finish button is clicked which brings up the analog input task configuration page. There we give the number of samples as “1 sample on demand”. A continuous task keeps all the samples in memory. An N samples task is usually used when we investigate any applications which are started by a trigger. Whenever the Led blinked, Comparator gave an output 1, else 0. All the 1s were then counted using an Adder to depict the total number of times Led blinked. Initial value in the adder is given as zero. The energy consumed and the numbers of Led blinks are related by the following formula.

\[
\text{Energy Consumed} = \frac{\text{No of LED blinks}}{3200} \tag{1}
\]

Where 3200 is the meter constant of the energy meter used [4].

Also,

\[
\text{Power consumed} = \frac{\text{Energy consumed}}{\text{total time taken}} \tag{2}
\]

And the amount is calculated as follows:

\[
\text{Bill amount} = \frac{\text{energy consumed}}{2.5} \tag{3}
\]

Where 2.5 is the cost per unit of electric energy consumed by the load. Here a 230 Volts, 200 Watts Bulb is used as the load.

IV. RESULTS

The LED pulses are bypassed from the energy meter through an optocoupler to LabVIEW software.

The overall experimental setup is given below.
The following figure shows the front panel and block diagram of the automatic meter reading system interfaced with DAQ module in LabVIEW.

![Fig 6. The Front Panel](image)

![Fig 7. The Block Diagram](image)

V. CONCLUSION AND DISCUSSIONS

Digital Energy meter has been interfaced with LabVIEW. The LED pulses from the energy meter is taken out via an Optocoupler and NI cDAQ 9172 to the LabVIEW. The energy consumed (in KWH) is then computed using LabVIEW Software.

The system designed gives information about the instantaneous value of energy consumed and the total bill at that point of time. On installing such a system, it helps the consumer in energy budgeting and proper scheduling of the energy as well. Changes can be made to the program code in LabVIEW in less time, if necessary, as per the requirements. Any modification in unit calculation or rate can also be put into action effectively.

In future, this system can be interfaced with GSM (Global System for Mobile communication) by making use of AT commands in LabVIEW. On implementation of such a system, the energy consumed can be read and sent to the service provider using the SMS (Short Messaging Services). When designed so, it also reduces the efforts of manual data collection from energy meter.

REFERENCES