

Energy Theft Monitoring System

Pawan P. Tawade , Mahesh Raut , Kapil Marde, M.P. Gajare

Abstract— Electricity is the modern man's most convenient and useful form of energy without which the present social infrastructure would not be feasible. The increase in per capita production is the reflection of the increase in the living standard of people. When importance of electricity is on the increasing side, then how much should theft of this energy or illegal consumption of power from the transmission lines is averted? Power theft has become a great challenge to the electricity board. The dailies report that Electricity Board suffers a total loss of 8 % in revenue due to power theft every year, which has to control. Our purpose to identifies the Power theft and indicates it to the Electricity board through Power line. We had also dealt about the remote monitoring of an energy meter.

Index Terms—Energy theft, Energy Meter, Remote Monitoring System, Electricity Board

I. INTRODUCTION

Today energy consumption has become a major driving force in every body's life. Today's life style is supported by the way we spend/ consume energy. Many people are very aware of the energy crisis and use the energy wisely but most of the populations don't use the energy wisely.

Also energy theft is of major concern today. Electricity Board is constantly trying to deal with the energy theft problem.

We are designing such a system in which Electricity Board can find out the area in which the energy theft is happening; also the amount of energy theft can be determined.

II. SPECIFICATION FOR THE SYSTEM

1.1.1 Functionality provided by the system

Real-time Power monitoring at houses.
Detecting the power theft at the particular location .
Transmitting the information over to the main substation

1.1.2 System interfaces, inputs, and outputs

Energy meter:

Here we using a conventional sub meter which gives the pulses to μ c. the μ c counts these pulses to calculate the instantaneous power and displays the reading on LCD. A serial e²prom memory IC 24c04 is used to store the current reading. If the light goes the μ c reads the units count and displays on LCD. An LCD display is being provided which displays the current status of the no. of units consumed.

Two rs-485 transceivers IC are provided for communication between the ENERGY METER and . Electricity Board based device using PC.

Distribution transformer:

This is the main transformer unit which supplies the whole current to the total area. The idea behind the project is that the current supplied by the main transformer should be equal to the unit consumed by individual areas. The reading of all the units is sent to the Electricity Board The Electricity Board PC then monitors the reading of all the units. If the energy unit consumed by individual units is not equal to the main distribution energy units then we can conclusively assume that energy theft is taking place.

Like the area1 and area2 units the mains transformer unit also has an energy meter to observe the total current consumed. All the 3 microcontrollers are connected via RS-485 LAN. The two society slaves keep sending the data to the distribution transformer unit.

We also have an Electricity Board based pc unit attached. Whenever the Electricity Board requests for the readings it sends the reading of all the units, so that the Electricity Board can determine whether energy theft is going on or not.

1.1.3 Expected Outcomes

Energy theft monitoring On/off of individual loads in case energy theft is detected Tampering with energy meter indication

1.2.4 System Requirement

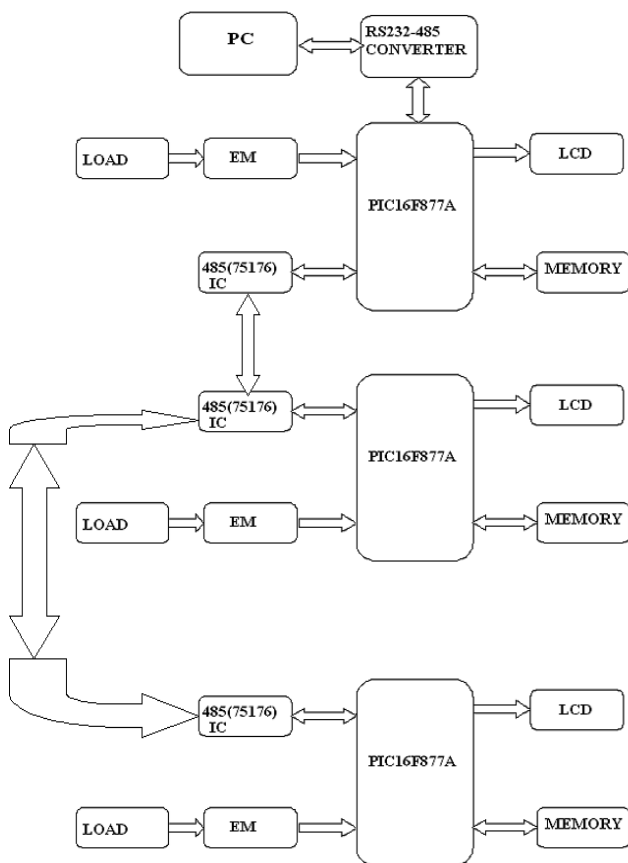
- i. Hardware Requirement
 - Microcontroller PIC16f877A
 - Serial memory
 - LCD
 - Relay
 - Rs 485 protocol
 - Rs 232 protocol
 - Energy meter
- ii. Software requirement
 - μ C programming:
Embedded C
 - GUI programming:
Visual basic
 - MPLABIDE is used for compiling the program,
After compiling creates the hex file
I.e. MPLAB IDE is used for creating a hex file

Manuscript received March 11, 2015.

Pawan P. Tawade , Mahesh Raut , Kapil Marde, M.P. Gajare,
Department of Electronics, AISSMS IOIT Pune-01.

III. BLOCK DIAGRAM OF SYSTEM

2.1 System Architecture Diagram



2.2 Working of Proposed System

Energy meter:

Here we using a conventional sub meter which gives the pulses to μ c. the μ c counts these pulses to calculate the instantaneous power and displays the reading on LCD. A serial e²prom memory IC 24c04 is used to store the current reading. If the light goes the μ c reads the units count and displays on LCD. An LCD display is being provided which displays the current status of the no. of units consumed. Two rs-485 transceivers IC are provided for communication between the ENERGMETER and Electricity board based device using PC.

Master unit: Distribution Transformer

This is the main transformer unit which supplies the whole current to the total area. The idea behind the project is that the current supplied by the main transformer should be equal to the unit consumed by individual areas. The reading of all the units is sent to the Electricity board The Electricity board then monitors the reading of all the units. If the energy unit consumed by individual units is not equal to the main distribution energy units then we can conclusively assume that energy theft is taking place.

Like the area1 and area2 units the mains transformer unit also has an energy meter to observe the total current consumed. All the 3 microcontrollers are connected via RS-485 LAN. The two society slaves keep sending the data to the distribution transformer unit.

We also have an Electricity board unit attached. Whenever the Electricity board requests for the readings it sends the reading of all the units, so that the Electricity board can determine whether energy theft is going on or not.

IV. HARDWARE DESIGN

3.1 Microcontroller: PIC16f877A:

We are choosing PIC16f877A for following reasons:

- Cheap, easily available
- Programmer available in college
- Plenty guidance available

3.2 PIC 16f877a μ c features:

- 10 bit inbuilt ADC 8 channels (an0 – an7)
- 40 pin i/o (a0-a5, b0-b7, d0-d7, c0-c7, e0-e2)
- Reset pin no. 1 (active low)
- Crystal pins at 13 -14 pin
- 1 serial half duplex port (rc7 (Rx) –rc6 (TX))
- Interrupts (rb0 (int0) - rb1 (int1))
- Inbuilt i2c bus (rc3 (scl) – rc4 (sda))
- Inbuilt spi bus (ss, SDI, sck, cs)

3.3 Serial memory:

Serial memory (24c04),
I2c bus protocol, smd chip

3.4 LCD:

- 16 char*2 line LCD
- Back lit facility
- 5*7 matrix display
- 8 data line interface
- 3 control lines (RS, R/W,EN)
- Operating voltage:5V
- Operating current:13mA.
- Total power:65mW

3.5 Relay:

- Operating voltage:12v
- SPDT relay
- O/p:- 230v, 5 amp.

3.6 Rs 485 protocol:

- Cabling: Multi-drop
- Number of devices: 32 transmitters & 32 receivers
- Communication mode: Half duplex
- Maximum distance: 4000ft to 100Kbps
- Maximum data rate: 100Mps for 50 feet
- Output current: 250ma

3.7 Rs 232 protocol:

- Cabling: single ended
- Number of devices: 1 transmitters & 1 receivers
- Communication mode: full duplex
- Maximum distance: 50 feet at19.2Kbps
- Maximum data rate: 19.2kbps for 50 feet
- Output current: 500 ma(Note that the driver ICs normally used in PCs are limited to 10 ma)
- Baud rate: 9600 bps, timer mode 1 auto reload mode
- Crystal : 11.0592 mhz

3.8 Energy meter:

- Type: RT-11
- Class: 1-0
- Ac single phase two wires 240v, 50Hz

- 5-30 A

V. SOFTWARE DESIGN

4.1.1 μ C programming: Embedded C

GUI programming: visual basic

4.1.2 Software used:

MPLABIDE is used for compiling the program, after compiling creates the hex file i.e. MPLAB IDE is used for creating a hex file.

Or-cad is used for draw the circuit diagram

Dip-trace is used for making a layout

VB6 is used for to create a GUI.

VI. RESULT ANALYSIS

5.1 Objective

- Real-time Power monitoring at houses.
- Detecting the power theft at the particular location .
- Transmitting the information over to the main substation

5.2 Advantages

- The system consumes very little power for its operation.
- System operation is independent of time (24 hours functioning).
- Automatic user identification
- Energy theft monitoring
- On/off of individual loads in case energy theft is detected.

5.3 Application

- Useful to identify the exact time when the energy theft is occurred.
- The system can be incorporated for almost all types of users.
- The concept is well suited especially for villages and interior areas

5.4 Limitations Since the techniques employed in this module are based on simple electronics, the chances of making the system inoperative are more. But, if a Microcontroller chip is used for feeding the modulating input, we can make the system more efficient.

- Wide range of frequencies is required to facilitate large number of users. To overcome this, carrier levels can be changed from region to region.
- Presently, it requires a power supply (230 V) for the operation, but a small battery with automatic charging facility can be provided in real time.

VII. CONCLUSION

In this project we present the energy theft monitoring system to identify the exact time when the energy theft is occurred as compare to old system we get the energy theft result at the end of month but in advance system we get the result at that time when energy theft occurred.

Thus we have concluded from our literature survey the old systems are not highly efficient it's a very expensive and time

consuming as compare to old system we do some useful modification on that as per future requirement.

Our aim is that to develop efficient system by considering design matrices:-

- Unit cost
- Size
- Performance
- Power
- Flexibility
- Reliability

On these design matrices we have selected hardware and software development tools as mention above

REFERENCES

- [1] Hu Xiaoxi; Zeng Xiangjun; Xu Yao; Jin Guangming, "A novel anti-theft and detection method of street lamp power cables," Modelling, Identification and Control (ICMIC), The 2010 International Conference on , vol., no., pp.76,81, 17-19 July 2010
- [2] Rong Jiang_, Rongxing Lu, Ye Wang, Jun Luo, Changxiang Shen, and Xuemin (Sherman) Shen "Energy-Theft Detection Issues for Advanced Metering Infrastructure in Smart Grid TSINGHUA SCIENCE AND TECHNOLOGY ISSN11007-02141101/1211pp105-120 Volume 19, Number 2, April 2014
- [3] W.A. Doorduyn, H.du T. Mouton, R. Herman and H.J. Beukes Dept. of Electrical and Electronic Engineering, University of Stellenhosch, South Africa. *Feasibility study of Electricity Theft detection using Mobile Remote Check Meters*, IEEE AFRICON 2004
- [4] Stephen McLaughlin, Brett Holbert, Ahmed Fawaz, Robin Berthier, and Saman Zonouz "A Multi-Sensor Energy Theft Detection Framework for Advanced Metering Infrastructures" IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, V L. 31, NO. 7, JULY 2013.