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Split Metering to Prevent Energy Theft

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ABSTRACT: "Power theft" is a non-ignorable crime that is highly prevalent and at the same time it directly affects the economy of the nation. Electricity is the modern man's most convenient and useful form of energy without which the present social infrastructure would not be feasible. When importance of electricity is on the increasing side, then why theft of this energy or illegal consumption of power should be ignored. Hence this Paper "Split metering to prevent energy theft" is proposed.

Electric Energy Meter (kWh) for domestic and industrial use are provided with anti-tampering features, in spite of these features, people try to steal electric energy by totally bypassing the meter and utility companies are incurring heavy losses in revenue. To stop these unethical practices – utilities have come up with the idea to install the meter in nearest electric mast of the consumer's house and install a remote display unit in the consumer's premises. Also the module for automatic meter reading is to be design.

KEYWORDS: Energy meter, Theft, RF transmission, PIC Microcontroller.

I.INTRODUCTION

The goal of our paper is to prevent energy theft. Consumer tries to theft Electricity by Bypassing the Meter or tampering the meter. To prevent such practices utilities have come up with the idea to install the meter in nearest electric mast of the consumer's house and install a remote display unit in the consumer's premises. In this consumer will not be able to do any changes in the meter, he can only see the meter reading on the display. Also the module for automatic meter reading is made easy by using this system. One may not have to visit every consumers Premises to take meter reading for billing purpose.

II.BACKGROUND

The system will be based on 1 Phase 2 Wire static Electricity meter along with Microchip PIC16F877A microcontroller and RF module to record meter reading and then the reading will be transmitted over RF to the remote data display to display energy consumption. The remote display unit will consist of a microcontroller PIC 16F876A with a RF receiver module and a seven segment LCD display.

The meter reading is captured through optical sensor which counts frequency through the continuously blinking led light on meter. This reading is then send to PIC microcontroller which gets saved in EEPROM. This reading is displayed on display connected to microcontroller for cross checking purpose. The data is then transferred through RF transmitter module at suitable frequency in the form of packets which are secured one. This data is then received at the receiver RF module which is remotely located at consumer's house, which is interfaced with microcontroller again along with display to take reading.

There is another device which is to be develop for automatically taking reading from Electric mast itself. It avoids the use of separate module for each meter instead it can take all readings from anElectric mast and will save time.

III.PROPOSED METHODOLOGY

The pulses from the Energy meter is read by phototransistor. These pulses are given to microcontroller at transmitter side. Microcontroller will convert the pulses into standard meter reading and save into EEPROM memory so that reading is not lost during power lost. This reading is transmitted by RF transceiver to the receiver side

Figure 1 shows the block diagram of transmitter section.

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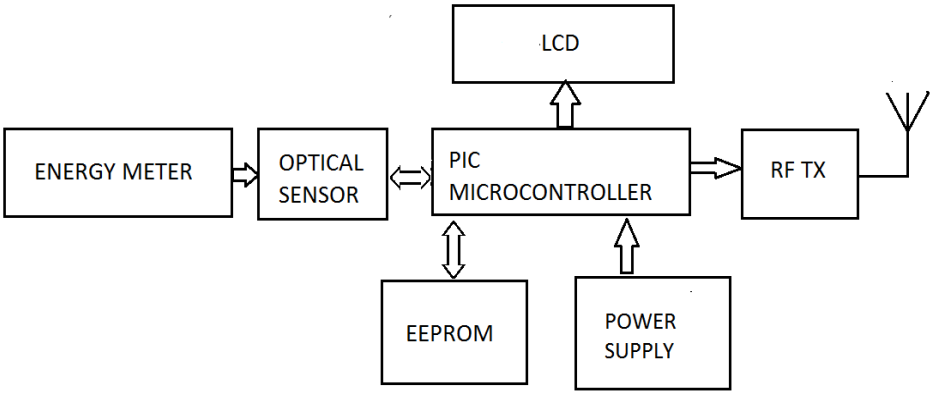

Figure 1: Transmitter block diagram

Receiver side will receive this reading Microcontroller will display this reading on the LCD at consumer premises. By using this system we can prevent energy theft and it will also be easy to take Meter reading for billing purpose.
Figure 2 shows the block diagram of receiver section.

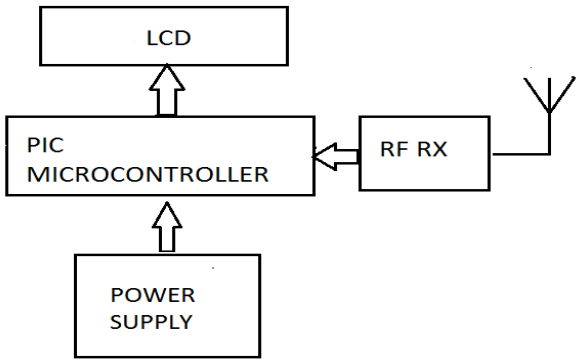

Figure 2: Receiver block diagram

TRANSMITTER SECTION:

Power Supply:

All digital circuits require regulated power supply.in this paper we require 5V, 1Amp power supply. The basic blocks required to design a power supply are transformer, rectifier, filter capacitor and voltage regulator

Energy Meter:

An electricity meter, electric meter, or energy meter is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device.Electric utilities use electric meters installed at customer's premises to measure electric energy delivered to their customers for billing purposes. They are typically calibrated in billing units, the most common one being the kilowatt hour [*kWh*]. They are usually read once each billing period. Here we are using AC 1 phase 2 wire static energy meter. It has aLED light which is constantly blinking. The frequency of blinking depends on the Energy being consumed.

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OpticalSensor (Phototransistor)

We are using BPW96 phototransistor. BPW96 is a high speed and high sensitive silicon NPN epitaxial planar phototransistor in a standard T–1(ø 5 mm) package. Due to its water clear epoxy the device is sensitive to visible and near infrared radiation. The viewing angle of ± 20_ makes it insensible to ambient stray light.

Phototransistor is placed near the meter where the LED is blinking. It will count the pulses and give it to Microcontroller.

Microcontroller

The microcontroller used here is PIC16F877A.It is a 40 pin IC. Microcontroller will count the pulses read by phototransistor and convert it into standard meter reading. This reading will be stored in EEPROM memory

RF Transceiver

We are using CC2500 RF Transceiver to transmit the data. The CC2500 is a low cost low power 2.4 GHz transceiver. Designed for very low power wireless applications. The circuit is intended for the 2400-2483.5 MHzand used for short range communication. CC2500 provides extensive hardware support for packet handling, data buffering, burst transmissions, player channel assessment, link quality indication and wake-on-radio.

CC2500 is used for communication between the two microcontrollers. One at transmitter side and other at receiver side. The transmitter will send the meter reading to the receiver which is located at consumer premises through this RF Transceiver.

LCD

LCD 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. In 16x2 LCD each character is displayed in 5x7 pixel matrix this LCD has 2 command register stores the command instruction given to LCD. The data register stores the data to be displayed on LCD.

It is used to display the reading at the consumer premises.

EEPROM

The Microchip Technology Inc. 24C32 is a 4K x 8 (32K bit) Serial Electrically Erasable PROM. This device has been developed for advanced, low power applications such as personal communications or data acquisition. The 24C32 features an input cache for fast write loads with a capacity of eight 8-byte pages, or 64 bytes.

It is used to store the meter reading as we may lose it in case of power loss.

RECEIVER SECTION:

RF Transceiver:

The same module CC2500 is used to receive the meter reading transmitted by RF transmitter. It will receive the reading and give it to microcontroller.

Microcontroller:

Here we are using PIC16F876A at the receiver side. It is a 28 pin controller. As there are less number of inputs/outputs at receiver side, 28 pins are enough for successful operation of the system. It reduces the cost and required space.

LCD:

The same 16 x 2 LCD is used at receiver side to display the reading at the consumer premises.

Power Supply:

5V, 1A regulated Power supply is designed for various components at receiver side.

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IV.RESULTS

We h**ave** designed power supply, transmitter and receiver section. We have simulated transmitter section and power supply using proteus software. We have also used other softwares such as MP Lab, Dock light, CCS C compiler. Programming is done using MP Lab and CCS C compiler in embedded C Language. Dock light used to simulate receiver section on PC.

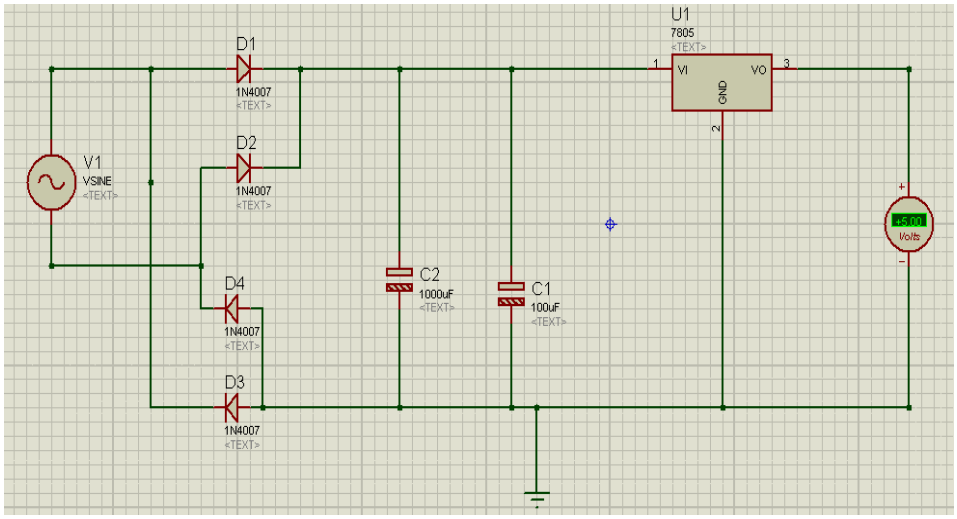

Figure 3: Power supply simulation

Figure 3 shows power supply simulation. We have designed DC regulated power supply for 5V, 1Amp, and simulated same using proteus software. This power supply is used for both transmitter and receiver microcontroller also for other modules.

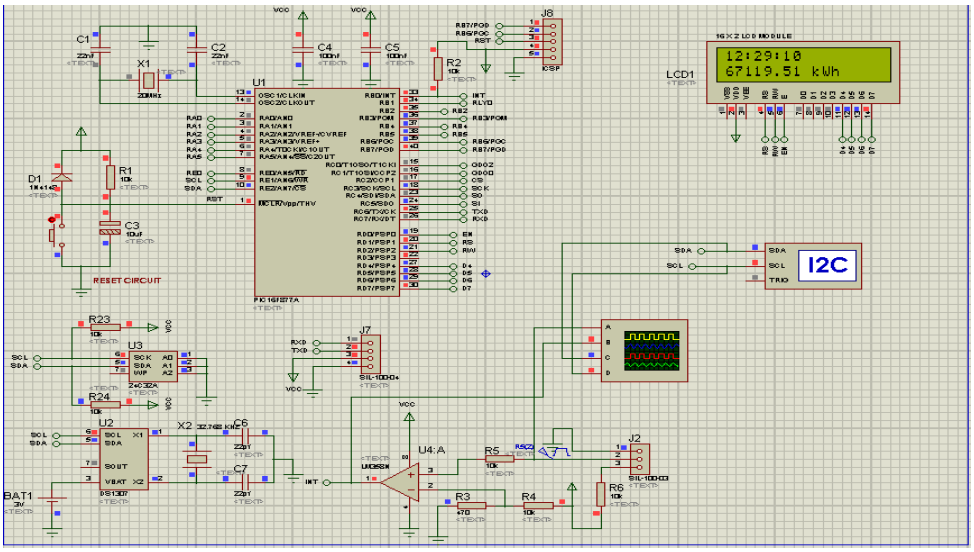

Figure 4: Transmitter simulation

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Figure 4 shows simulation for transmitter section. Pulses from phototransistor is given to amplifier circuit which amplifies the weak signal and is given as interrupt to PIC16F877A microcontroller. Controller processthese pulses and stores it in EEPROM also displays it on 16x2 LCD. The same reading is transmitted through RF Module.

V.CONCLUSION

Government is facing lots of revenue loss due to illegal consumption of energy by tampering the meter or bypassing the meter. By taking this problem into consideration, we have designed a system "Split metering to prevent energy theft" which prevents the user from doing any kind of energy theft. The system successfully counts the pulses by Phototransistor and converts it into Standard meter reading. This reading is correctly displayed on receiver side LCD.

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