



Wireless Electricity Theft Detection by using ZIGBEE Technology

S.N.Swami¹, A.B.Ghayal², H.G.Tamboli³, R.R.Suryawanshi⁴

UG Students, Dept. of EE, S. B. Patil Engineering College, Indapur, Maharashtra, India¹⁻³

Assistant Professor, Dept. of EE, S. B. Patil Engineering College, Indapur, Maharashtra, India⁴

ABSTRACT: The project aim is designing a system which utilizes to detect the theft this technique named ZIG-BEE because all the problems associated with the wired techniques. There are a lot of problems related with the wired techniques such as installation problem, complexity and cost. The main problem associated is about the rural areas where it is really very much difficult to install the wired system to convey the information. The ZIGBEE module provides an efficient way to convey this information to the authorized company at low cost as compare to that of the GSM Modem and also utilizes a cell-phone to send the message to the modem having a long battery life. The other wireless techniques such as Bluetooth, infrared etc. are having the limitations of range and also of the efficiency. The wireless system based on GSM/GPRS is well known. But the fee is needed of using GSM/GPRS network, and also the cost of hardware system is very high. In this system ZIGBEE technology which works in international free frequency band and access self organization function is adapted to solve the problem in this wireless electricity theft detection system.

KEYWORDS: Zigbee, Microcontroller, Efficient Communication, Power meter.

I.INTRODUCTION

According to the survey, Indian Power System faces loss of about 30% of its total production of electricity. This loss is very high which takes place because of transmission losses, electricity theft, etc. Major portion of its losses is due to power theft. Power theft is done by taking tapping or hooking from transmission line or by from the meters. Generally this type of power theft is seen in residential area which can't be easily detected as this type of theft is done during night hours. Moreover, this kind of power theft causes unbalance/overloading of three phases of distribution transformer. Due to unbalance/overloading condition, the transformer is damaged due to heating of the overloaded phase. Power consumption and losses have to be closely monitored so that the generated power is utilized in an efficient manner. This illegal electricity usage may indirectly affect the economic status of a country. Also the planning of national energy may be difficult in case of unrecorded energy usage. This electricity theft is reduced by using wireless electricity theft detection by using system.

II.LITERATURE SURVEY

In the paper [1], they said that wireless electricity theft detection system using Zigbee technology present an efficient and less costly way to adulterate the wireless technique used in this research paper. This wireless system is used to overcome the theft of electricity via bypassing the energy meter and hence it also controls the revenue losses and utility of the electricity authorized agency. In the paper [2], they provide insight into the illegal use or abstraction of electricity in the Netherlands. The importance and the economic aspects of theft detection are presented and the current practices and experiences are discussed. The paper also proposes a novel methodology for automated detection of illegal utilization of electricity in the future distribution networks equipped with smart metering infrastructure. The necessary data requirements for smart meters and distribution substations are defined, in order to unlock this feature in distribution network.

III.METHODOLOGY

Fig 3.1 shows Digital energy meter (M1) will measure a consumed power by load (L1) over a period. It will send a data in proportion with consumed power to receiver with the help of wireless digital data transmitter. Receiver on the pole system will receive a data sent by transmitter in a load side meter. Receiver will send it to microcontroller. Also energy

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

meter on pole will measure power sent over line1 and provide appropriate data to microcontroller. The microcontroller conveys the information to the relay and switches and power supply of the system. Hence the LCD displays the message, “Meter is ok”. Now microcontroller has two readings one is power calculated on pole itself and another is power consumed by load (L1).

Suppose there is tapping done by any unauthorized person on the line to connect his appliance as shown in figure 2.1 Over a certain period there will be difference between meter reading (M1) and pole based reading. Microcontroller will compare these two values and if the measured value on pole is more than value send by meter (M1) by some tolerance then power theft is happening on line1. This theft signal generated on pole system can be transmitted to substation by power line communication technique or by wireless technique whichever is suitable an economical. Tolerance should be provided for losses of line. Because over a long period there will be difference in reading of meter on load side and pole side due to loss of line between pole and load. Therefore tolerance should be provided through programming of micro-controller. The resistance change is monitored by microcontroller and the load will cut out by showing the message that “Meter is tempered”, LCD displays the message, and this message sends to authorized official.

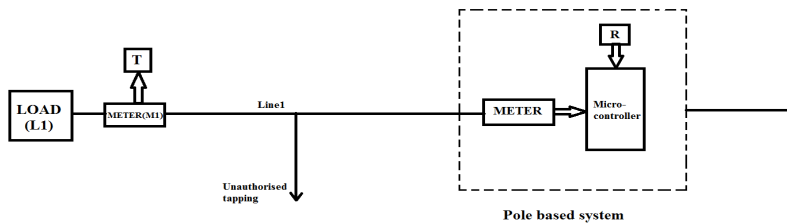


Figure 3.1: Power theft detection

Now a day utility company personnel goes at every house to take the readings of meters for billing purpose. It will create problem when consumer is out of Town or home is locked due to other reasons. This system of wireless meter reading is based on the same principle of wireless data transmission that is used in power theft detection. Utility company personnel will have a device consists of wireless data receiver with microcontroller and display. When that device is in the range of data reception it will receive the data sent by transmitter in the load side meter. For this one counter has to be installed in the load side meter (shown in figure2-2). It will keep a record of power consumed by load over a given time (say one month).This recorded data will be send by transmitter wirelessly.

Receiving device will receive the meter reading and keep its record with consumer serial number. For this device should be in the range of transmitter. Hence, utility company personnel don't have to check every meter. He can take reading without going to consumer's house. This is time saving technique.

IV.BLOCK DIAGRAM

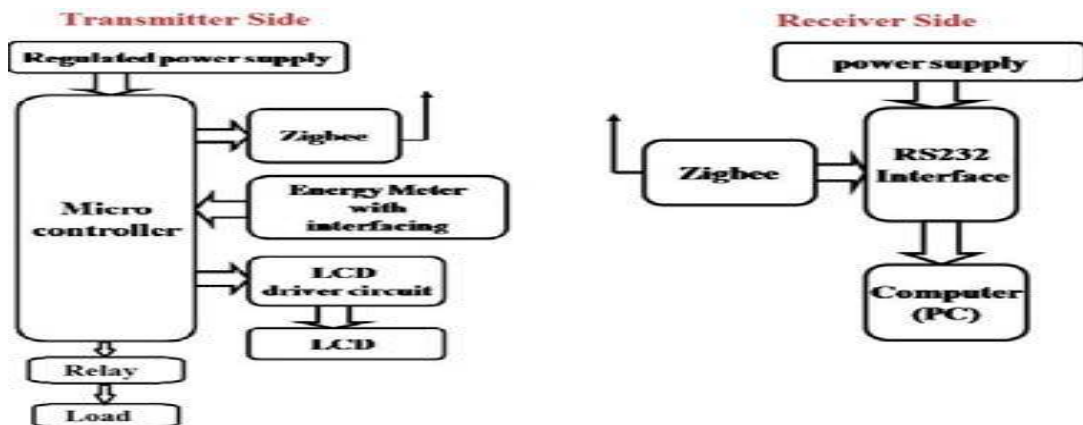


Fig 4.1 Block Diagram



International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

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Vol. 5, Issue 3, March 2016

Theft Sensor:

They act like the sense organs through which the system observes its surrounding environment and transfers the information regarding to the microcontroller (the brain) where it is processed. The sensors cover a variety of angles depending on the shape of the area you want to protect.

Power Supply:

Any circuit needs power to operate. The required power can be obtained by using a transformer, rectifier and regulators. Basically any electronic circuit needs 5V to 12V DC supply.

Max232:

The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The controller operates at TTL logic level (0-5V) whereas the serial communication in PC works on RS232 standards (-12V to +12V). The intermediate link is provided through MAX232. It is a dual driver/receiver that includes a capacitive voltage generator to supply RS232 voltage levels from a single %V supply. Each receiver converts RS232 inputs to 5V TTL/CMOS levels.

Microcontroller:

The program is written in microcontroller internal 8KB flash for reading the data form sensors, analyzing the situation and to deliver the pre-recorded text message, simultaneously turning the buzzer ON in case of any bypassing the energy meter. It displays the recorded message to authorized officials.

Zigbee module:

A Zigbee module is transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. Zigbee is typically used in low data rate applications that require long battery life and secure networking. The Zigbee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or Wi-Fi.

Buzzer:

A buzzer or beeper is an audio signalling device. In our project when the energy meter is bypassing within time period, otherwise the buzzer rings and automatically sends the message using Zigbee modem.

LCD:

LCD is used for the display purpose. Here in our project 16x2 LCD is used.

V. CC2500 RF MODEM

Fig 5.1 shows CC2500 RF Modem is a transceiver module which provides easy to use RF communication at 2.4 Ghz. It can be used to transmit and receive data at multiple baud rates from any standard CMOS/TTL source. This module is a direct line in replacement for your serial communication it requires no extra hardware and no extra coding to turn your wired communication into wireless one. It works in Half Duplex mode i.e. it provides communication in both directions, but only one direction at same time (not simultaneously). This switching from receiver to transmitter mode is done automatically.

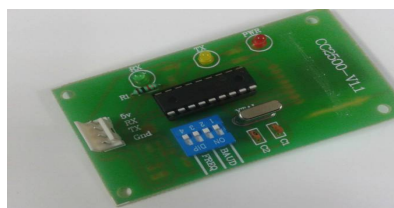


Fig 5.1 CC2500 RF MODEM



International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

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Vol. 5, Issue 3, March 2016

Features:

- Supports Multiple Baud rates (4800/9600/19200/38400).
- Works on ISM band (2.4 GHz) which is reserved internationally so no need to apply for license.
- Supports multiple frequencies within the same band rate thus avoiding data collision.
- No complex wireless connection software or intimate knowledge of RF is required to connect your serial devices.
- Designed to be as easy to use as cables.
- No external Antenna required.
- Plug and play device.
- Works on 5-9v DC supply.
- Standard UART Interface.

Specification:

Name Min Typical Max Units
Working Voltage 4.5, 10 Volts
Frequency 2.4 GHz
Range 15 25 30 Meters

The unit supports multiple baud rates and multiple frequency channels. The settings will take place only during power on i.e. you will have to restart the module every time you change the setting. Switch number 1 & 2 are used to set the baud rate. Whereas switch number 3 & 4 are used to select channel frequency. Channel frequency allows you to use more than one set of RF module without interfering with each other. Pairs will same channel frequency will be able to communicate with each other. Thus avoiding data collision between multiple set of units.

VI. FLOWCHART

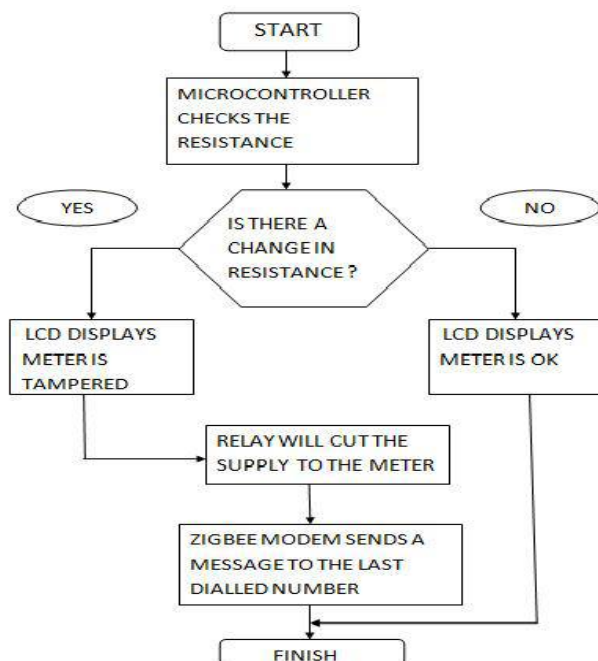


Fig 6.1 Flowchart



ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

VII.CONCLUSION

The Power theft is an economic crime that adversely affects all utility customers. Utilities estimate that 0.5 to 1.0 percent of all customers steal from them and that their annual losses exceed \$1.7 billion in power and \$1.3 billion in natural gas. Power Theft is a non ignorable crime that is highly prevented. Thus an attempt is made in this paper to detect power theft and controlling it. In future the proposed model can be improved by adopting modern meters, tamper proof seals and tamper resistance locks to discover tampering and to secure electric meter against it with more accurate results.

VIII.ACKNOWLEDGEMENT

We have great pleasure in delivering the report on the topic WIRELESS THEFT DETECTION SYSTEM USING ZIGBEE TECHNOLOGY ". This report has helped me to express my gratitude towards Honourable Principal Dr. P.D.Nemade and Project Co-ordinator Prof.U.A.Chatte for his support.

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