MANTECH Publications

Journal of Current Trends in Electrical Engineering
Volume 1, Issue 3, September-December, 2016

Wireless Smart Metering System

Ashwini B. Waghchaure[1], Kavita S. Tated[2]

Department of E & TC

SNJB's L. S. K. B. Jain CoE, Chandwad Nasik, India

***Corresponding Authors' E-mails**: Ashwinipatil1414@gmail.com[1], Kavita.tated@gmail.com[2]*

Abstract

In this paper, associate energy calculation through wireless good meter mistreatment Zigbee is planned for automatic meter information assortment, offer indication through messages displayed on LCD and energy auditing. During this paper, we tend to discuss totally different hardware techniques for tripping, representing, indicating the shoppers and power observation. It is the ARM7 Processor primarily based system that ceaselessly records the readings and mechanically takes the responsibility of scheming the bill with the information acknowledged from the energy meter, and also the bill provided by the operator and displays an equivalent. The design presents a novice methodology of combined Zig-bee and international System for Mobile communication (GSM) technology to observe the facility consumption and dominant of the meters remotely. This technique avoids the human intervention in power management.

***Keywords:** GSM (global system for mobile), ARM-7, smart meter, LCD*

INTRODUCTION

Smart meter is an innovative energy meter that measures the energy consumption of a customer and provides added information to the service by using a two-way communication scheme. Consumers are better informed in their consumption of their energy, so they can make better decisions when they are using the energy. Suppliers on

the other hand would not need the conventional way of physically reading the energy consumed as they would get this information automatically. The system that utilizes one-way communications to collect the data is referred to as automated meter reading (AMR) system [1–3].

While the system that utilizes two-way communications with the ability to control and monitor the meters is referred to as advanced metering infrastructure (AMI) system [2]. The combination of automatic reading and two-way communication are the intention why the meter is named smart and they are also the difference betweenthe traditional energy meter and the smart meter.

The purpose of AMR technology is to do the meter reading automatically and correct [1]. The benefit of AMR is reducing the meter cost to the supplier and billing the customers with actual meter readings. The ARM Processor habitually takes the responsibility of computing the bill with the data received from the energy meter, and the tariff provided by the operator.

The wireless technology is enforced by having a Zigbee enabled transceiver interfaced with the EB unit server, moreover, as within the shopper aspect ZigBee may be a key technology for the sensible grid considering its automatic controllability of applications, ability to manage devices, and lower installation and upgrade value.

ZigBee can deal meter tometer communication and remote monitoring ability of whole home conditions. Radiofrequency identification (RFID) is used for payment of bill anywhere, each consumer is having a unique code with it consumer pay the bill at the consumer side [4, 5]. Theft detection technique is used to avoid illegal use of electricity. The theft detection is done by comparing the input and output power.

LITERATURE SURVEY

For this work existing meter reading techniques in Republic of India square measure examined and directed an intensive study on completely different energy measure instruments offered currently. In existing system either one associate in nursing electronic energy meter or associate in nursing electromechanical meter is put in within the premise for measure the usage.

The meters presently in use square measure solely ready to record weight unit Watt hour units. The kWh units used then still got to be recorded by meter readers once-amonth on foot. The recorded data need to be processed by a meter reading company. For processing the meter reading, company needs to firstly link each recorded power usage datum to an account holder and then determine the amount owed by means of the specific tariff in use. Md. Wasi-ur-Rahman, et al. proposed technique for remotely reading electricity meter readings using Short Message Service (SMS) has been explained. Existing Global System for Mobile communications (GSM) networks have been used for transmitting and reception SMS. Dr. Mohd Yunus B Nayan, et al. propose hybrid Automated Metering Reading (AMR) system which is a grouping of ZigBee and GSM technology.

SYSTEM DEVELOPEMENT

Block Diagram

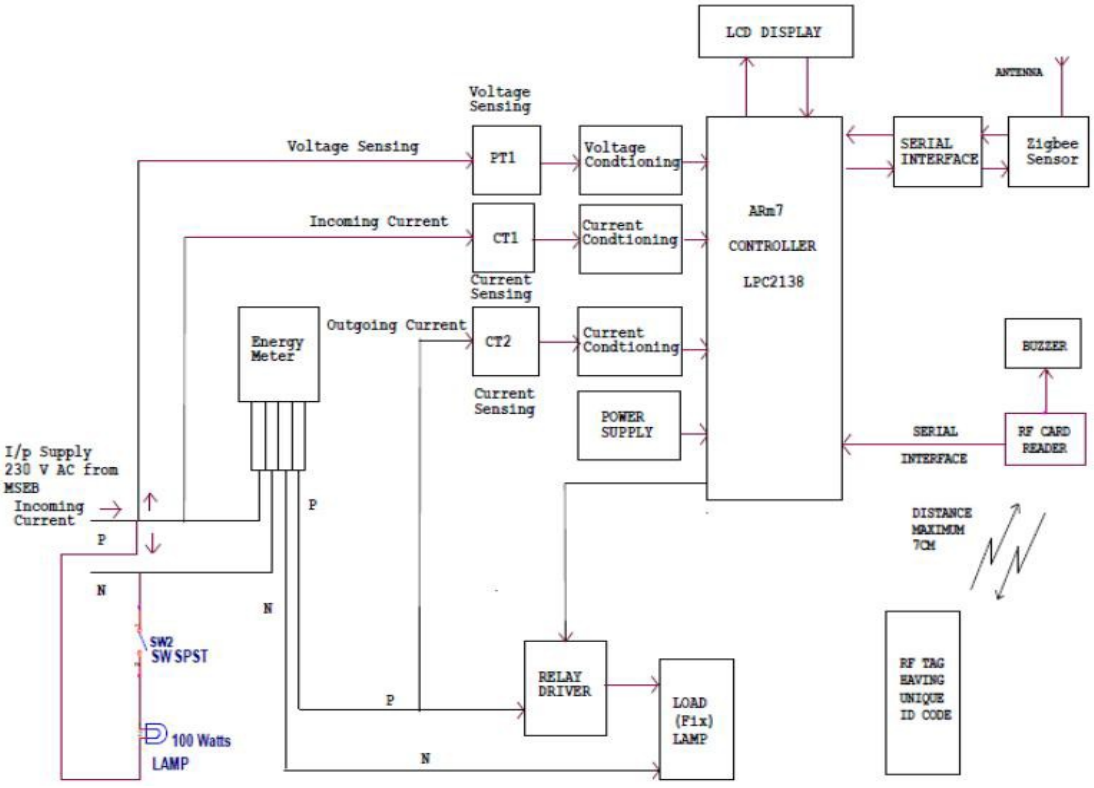

Fig. 1: Block Diagram of System.

In this propose system ZigBee module is attached to the electric meter by using interface board and the data collector will be connected to the central computer by using GSM. Gordon Štruklec, Vedran Bilas proposition a wireless automatic water-meter reading system founded on ZigBee technology. The wireless automatic water-meter evaluation system presented here uses ZigBee networking to avoid difficulties and problems inherent to other meter reading techniques Li QuanXi1, Li Gang propose domestic metering system design based on Zigbee and GPRS technologies, using PIC18LF4620 as the core processor and CC2430 chip asclose communication function, using SIM300 chip as communication utility in distance [6, 7].

This project uses dual power supply, one is regulated 5V for modules and other one is 3.3V for ARM 7 microcontroller.7805 three terminal voltage regulators is used for voltage deregulations. Bridge type full Wave rectifier is used to rectify the ac output of secondary of 230/9V step down transformer [8].

ZigBee is a low-cost, lowpower, wireless mesh network standard. The low cost makes the technology to be widely deployed in wireless control and monitoring applications. Low power-usage allows extended life with small in size of batteries. Mesh networking provides high reliability and more extensive. The currentscheme of energy metering as well as method to generate bill in Bangladesh which use electromechanical and someplace digital energy meter is error prone and it consumes more time and labour.

The conventional electromechanical meters are being replaced by new electronic meters to increase accuracy in meter reading. Still, the Indian power sector faces a serious problem of income collection for the real electric energy supplied owing to energy thefts and network losses. One of the prime reasons is the old-style billing system which is inexact many times, slow, costly, and lack in flexibility as well as reliability. A Prepaid Energy Meter enables power utilities to collect electricity bills from the consumers prior to its consumption. The pre-paid meter is not only restricted to Automated Meter Reading but is also attributed with prepaid ability to charge and information exchange with the utilities pertaining to customer’s consumption details.

The use of electronic token pre-payment metering has been commonly used in UK for customers with poor record of payment a system proposes a design of a system which can be used for data communication between the personal computer and smart cards. Alternative to this paper suggests making use of state of art technologies like Wi-MAX in Prepaid Energy. Proposed and developed based on local prepayment and a card reader Wireless prepaid energy metering system have been suggested which incorporate RF based system.

Digital energy metering system as an alternative for the electromechanical system have been suggested and developed with the input output Interface into Controller (ARM7) and necessary software. Because of the low cost of microcontrollers, Prepaid Energy Meter has been developed using a micro controller from the Microchip Technology Inc. ARM7LPC2138 family.

In this Project, we have proposed a microcontroller based single phase digital Prepaid Energy Meter using dual microcontroller from the Atmel AVR family due to its performance, power efficiency and design modularity and an Energy Meter IC. In this paper a credit card is used which is capable of communicating with both the distributor unit from where the credit card have to be recharged and the energy meter to which the number of recharged units to be loaded.

An electronic circuit widely known USB burner circuit is used to load the recharged units both in energy meter and smart card. Zeegbee Module ZigBee could be a affordable, low-power, wireless mesh network normal. the limited value permits the technology to be wide deployed in wireless management and observance appl ications. Low power-usage permits longer life with less weighted batteries. Mesh networking provides high reliableness and additional in depth vary. ZigBee chip vendors generally sell integrated radios and microcontrollers in between 60 KiloBits and 256 KiloBits nonvolatile storage. ZigBee operates in the industrialized, scientific and medical (ISM) radio bands; 868 MHz in Europe, 915 MHz in the USA and Australia and 2.4 GHz in most jurisdictions worldwide.

Data transmission rates differ from 20 kilobits/second in the 868 Megahertz frequency band to 250 kilobits per second in the 2.4 GHz frequency band.

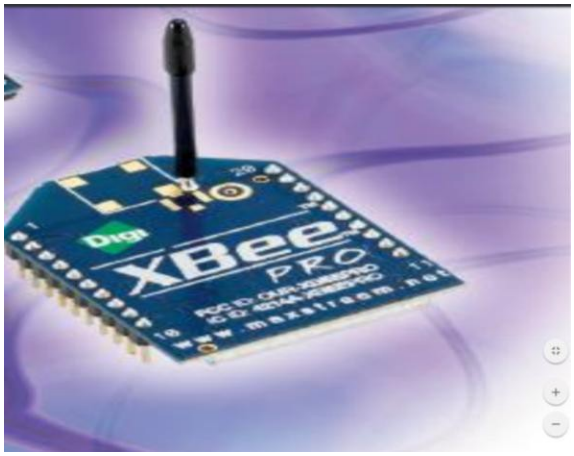

Fig. 2: Zeegbee Module

ZigBee network layer natively maintenances both star and tree typical networks, and generic mesh networks. Every network must have one coordinator device, tasked with its creation, the control of its elements and basic maintenance. Within star networks, the coordinator must be the central node. Both the Meshes and trees allow using of ZigBee routers to extend communication at the network level. ZigBee builds upon the physical layer and media access control defined in IEEE standard 802.15.4 (2003 version) for low-rate WPANs. The specification goes on to finish the standard by adding 4 major components: network layer, application layer, ZigBee device objects (ZDOs) and manufacturer-defined appliancesobjects which allow for customization and favour total integration.

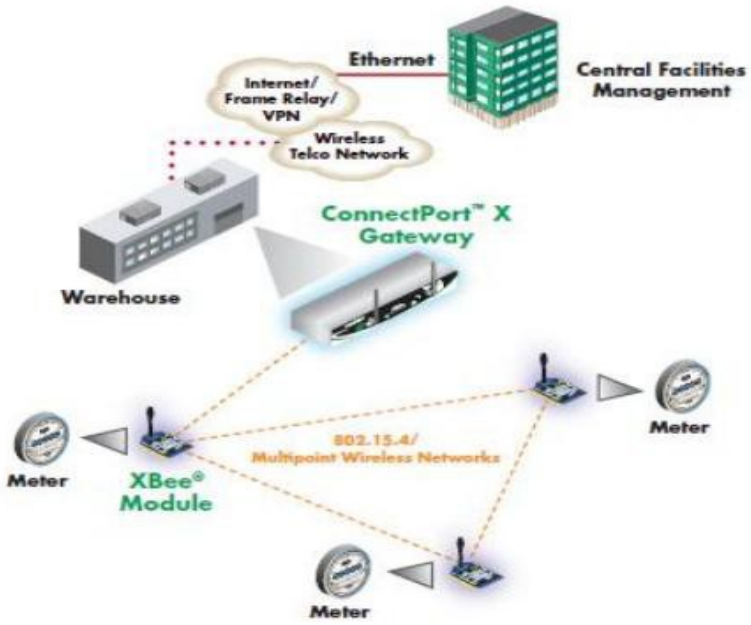

Fig. 3: Zeegbee Communication Network.

The fundamental structure, the most significant improvement is the introduction of ZDO's these are responsible for a figure of tasks, which comprise keeping of device roles, management of requests to join a network, device discovery and security.

ARM 7

The LPC2131/32/34/36/38 microcontrollers area unit supported a 16/3 2 bit ARM7TDMICPU with period emulat ion and embedded dash supportive to combines the microcontroller with 32 computer memory unit, 64 kB, 128 kB, 256 computer memory unit and 512 computer memory unit of embedded high speed non-volatile storage. A128 bit intensive memory interface and single accelerator design modify 32-bit code execution at extreme clock rate. For serious code size applications the choice 16-bit Thumb Mode reduces code by quite 30 percent with nom inal performance penalty.

With a wide variety of serial communications interfaces and on-chip SRAM options of 8 or 16 or 32 kB, they are very well suited for communication gate-ways and protocol converters, modems, soft voice recognition and low end imaging, providing both large buffer size and high processing power. Several 32-bit timers, single or dual 10-bit 8 channel ADC(s), 10-bit DAC, PWM channels and 47 General Purpose IO lines with up to nine edge or level sensitive external interrupt pin makes these microcontrollers particularly suitable for industrialized control and pharmacy systems.

RFID

RFID is short for Radio Frequency Identification. Generally a RFID system consists of 2 form parts. A Reader, and one or more Transponders, also known as Tags. An RFID system evolved from barcode tags concludes to routinely identify and track products and people. We are generally familiar with RFID systems as seen in.

RFID Readers placed at entrances that need someone to pass his or her proximity (RFtag) to be "read' before the access are often created. RFID tags accustomed carry payment info.

RFIDs are explicit suited to electronic toll assortment systems. Tags connected to vehicles, or carried by individuals expenditure information to a hard and fast reader connected to a Toll station. Payments are then regularly with help from a user's

account, or info is modified directly on the RFID Tag. RFID systems are commonly used to track and make storage of the movement of ordinary items such as library books, clothes, factory pallets, electrical goods and numerous items.

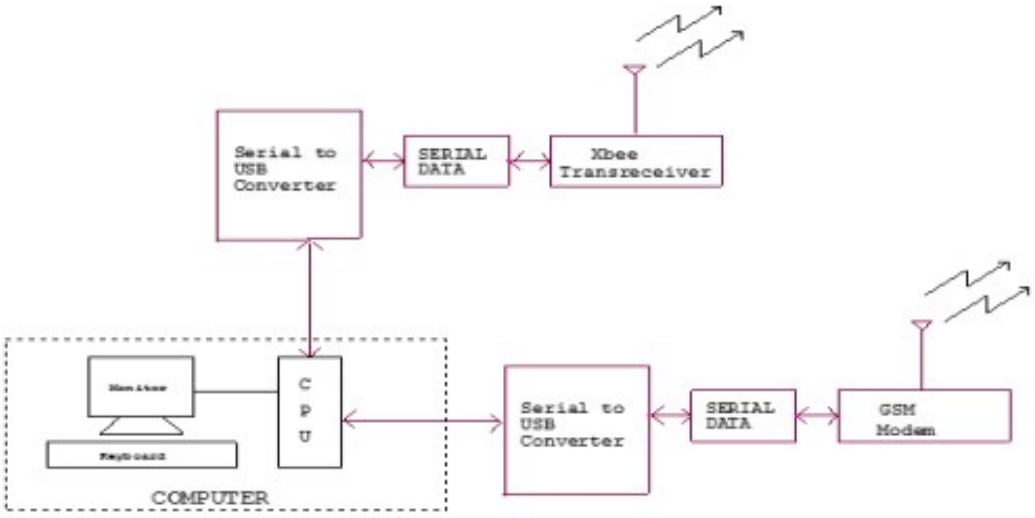

Fig. 4: RF at PC Side

RESULTS

Fig. 5: Energy Consumption Bill

In this project, we are using the dot net language for editing and compiling and debugging data base can be generated to store the details of the customer in the form of history for future use. In dot net we can generated all billing information and smart communication with customer. These billing related information sent via Short Message Service.

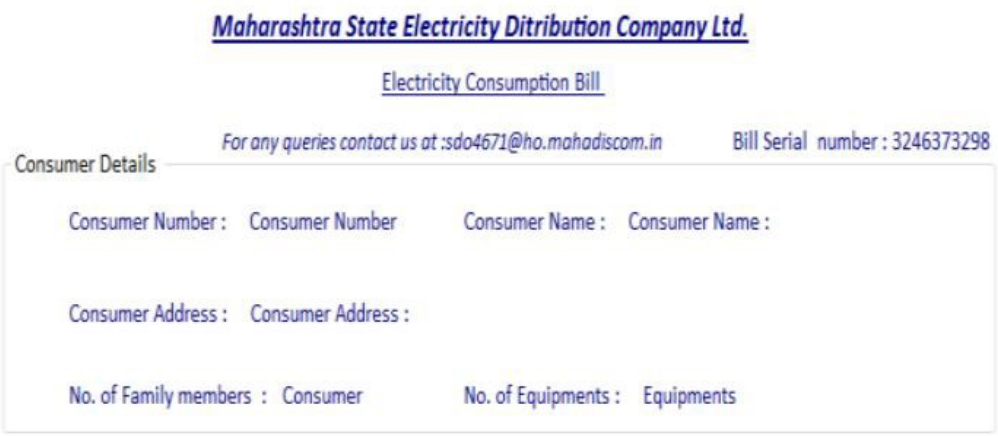

Fig. 6: Consumer Database and Bill Generation

Fig. 7: System Hardware Transmitter and Receiver

Observation and Result Analysis

Fig. 8: System Hardware Transmitter and Receiver

Fig. 9: Automatic Meter Reading when Load is ON

For the demo purpose we use the 100 watt bulb as a load and meter reading received through the microcontroller and zigbee section control action are validated by giving command through pc to the controller below Figure 9 shows the Automatic meter reading transmitter unit when load is ON. Figure 10 shows SMS of electricity bill generation, i.e., which shows all the billing information like bill for month, Unit, amount and due date send through GSM modem to consumer mobile when consumer pay bill using GSM modem.

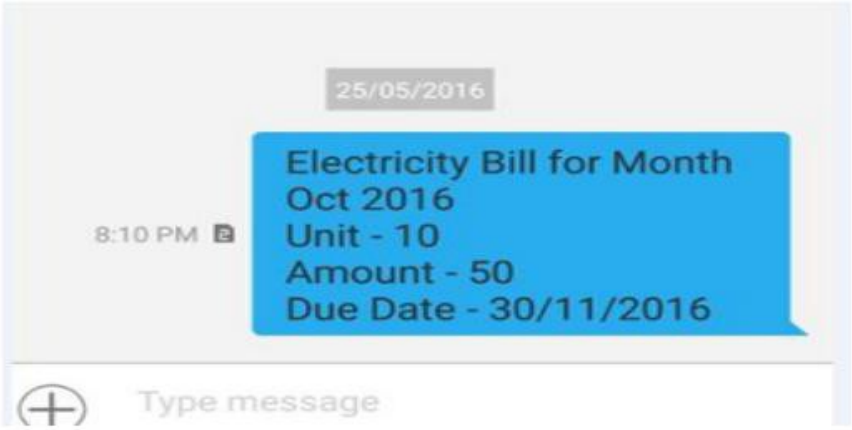

Fig. 10: SMS Generation on Mobile

CONCLUSION

An automatic energy calculation through wireless smart meter using Zigbee communication has been designed, fabricated and tested successfully. This reduces the work of the office person to a great extent. It also reduces the difficulty faced by the people when readings are taken manually. It simplifies the work of the electricity board in tripping the supply to a particular customer in case bill is not paid.

ACKNOWLEDGMENT

I acknowledge my sincere thanks to Prof. Kokate M. D, Principal, SNJB's K.B.Jain C.O.E., Chandwad and Prof. Dr. Wankhede V. A., HOD, Department of Electronics and Telecommunication Engineering, and Prof. Agrawal R. K., M.E. Coordinator for their indispensable support and allowing to use infrastructural facilities to work in, without which this work would not have been possible. Also, I would like to thank my Parents for their support, co-operation and constant encouragement.

REFERENCES

[1] Chih-hsien Kung, Devaney, M.J. Multirate digital power metering. Instrumentation and Measurement Technology Conference. 1995; 179–182p.

[2] C.P. Young, M.J. Devaney. Digital power metering manifold. In Proc.1997 IEEE Instrumentation and Measurement Technology Conference. 2: 1403–1406p.

[3] Misra, R.B., Patra, S. Tamper detection using neuro-fuzzy logic [static energy meters]. In Proc. 1999 IEE Metering and Tariffs for Energy Supply Conference. 101–108p.

[4] Siemens Inc. MC35 Hardware Interface Description, Version: 05.00, DocID: MC_35_HD_01_V05.00, 2002.

[5] Constantinos F. Grecas, Sotirios I. Maniatis, Iakovos S. Venieris. GIP: an infrastructure for mobile intranets deployment. Wireless Networks, Kluwer Academic Publishers. 2003; 9(4): 321–330p.

[6] Available at: http://www.tnb.com.my/residential/b ill ing/penalties-and-charges.html, access date 24/02/2012.

[7] Available at: http://www.wiscore.com/, NET-Start production information.

[8] Available at: http://www.µClinux.org, Embedded Linux/Microcontroller Project.