

Zigbee Based Smart Home Energy Management System Including Renewable Energy Sources

Mr. Chetan D. Pande

PG Student

**Department of Electronics and Telecommunication
Engineering,
Maharashtra Institute of Technology,
Aurangabad (MS), India.**

Dr. Ganesh S. Sable

Head of the Department

**Department of Electronics and Telecommunication
Engineering,
Maharashtra Institute of Technology,
Aurangabad (MS), India.**

ABSTRACT

In this application we can generate the energy using renewable energy sources one is by using solar energy, another one is wind mill and one more the optional source is conventional power. These energy sources we are connecting to the grid via battery and inverter, Parallely the battery output is connected to micro controller unit and these microcontroller is connected to LCD for displaying which source is available and also for displaying the battery voltage. Whenever the load is connected some units will be consumed, these units will be calculated and displayed on the LCD by using controller and the total transmitter section information is transmitted to receiver section and displayed on the Pc through a wireless communication by using Zigbee technology.

INTRODUCTION

As home energy use is increasing and renewable energy systems are deployed, home energy management system (HEMS) needs to consider both energy consumption and generation simultaneously to minimize the energy cost. Here a smart HEMS architecture that considers both energy consumption and generation simultaneously. ZigBee based energy measurement modules are used to monitor the energy consumption of home appliances and lights. The current energy crisis requires significant reduction in energy consumption in all areas. Energy saving and renewable energy sources (RES) are considered as methods of solving the problem. In home area, the increasing number of home appliances and consumer electronics causes residential energy use to grow

rapidly. Home energy management system (HEMS) is needed to reduce energy use and save money. A HEMS that monitors, compares, & controls home appliances has been proposed. In addition, RES such as a photovoltaic energy and wind energy are deployed to conserve residential energy use & to reduce energy cost. Energy management systems including renewable energy have been studied to advance smart home.

NEED OF THE PROJECT

As the numbers of large-sized electric home appliances are increasing, the home energy consumption is also increasing proportionally. To reduce the home energy cost, it is necessary to consider both energy consumption and generation. In this application intelligent home uses renewable energies. The problems of home energy management systems are solved by implementing energy saving method and renewable energy sources. Hence The concept of home energy management system has been an interesting topic for researchers and practitioners during the last few years. The majority for recent techniques concentrate on exploiting wireless communications on the way to make communicate with the other devices such as Mobile phones and Laptop's. Controllers are interface with the Bluetooth for display the reading in mobile phones and Laptops. But the Bluetooth range is short then it cannot send the reading information's for longer distance. Now-a-days there are lots of techniques used to send the data for longer duration. In this project, we propose smart home energy

management system including renewable energies based on ZigBee to optimize home energy use.

EXISTING SYSTEMS

In a paper [1] the authors suggested smart HEMS system with the MPPT (Maximum Power Point Tracking) technique. By using this technique we can increase energy generation by using the same hardware setup. In this system the energy meters are not employed. Simple smart home energy management system using PIC controller is developed. Another paper [2] proposed the technique of the power supply distribution and management based on the demand basis. The overall system comprises an HEM unit that provides monitoring and control functionalities for a homeowner, and load controllers that gather electrical consumption data from selected appliances and perform local control based on command signals from the HEM system. In another paper [3] proposed the simple home energy management system using IR sensor and ZigBee. In this project they have used AVR microcontroller and they proposed only the energy management system by using IR sensor for operating the appliances from remote places. Another paper [4] explains the system with the low energy application by using Bluetooth. Controllers are interface with the Bluetooth for display the reading in mobile phones and Laptops. But the Bluetooth range is short then it cannot send the reading information's for longer distance. Zigbee based Smart home energy management system are integrated with Wi-Fi network through gateway. Gateway can provide the user interface and openness to the particular system. Through using Zigbee designed for take the electrical readings such as energy consumption from home appliances. In the paper [5] system architecture for the smart grid is presented. Requirements of security and solutions for cyber-attack in the smart grid also discussed.

PROPOSED SYSTEM

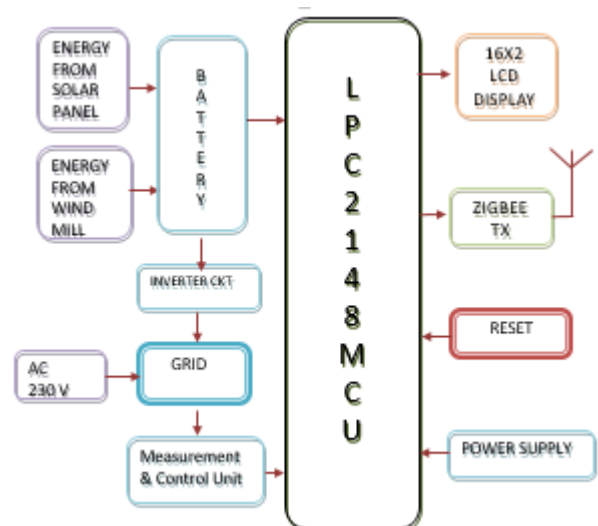
In the proposed system, we are implementing a simple home energy management system including renewable energy using ZigBee wireless technology. In this

system we are using ARM 7 Microcontroller (LPC2148). For energy generation purpose we are using solar panels and wind mill. Also the energy meters used for measurement purpose. 16*2 LCD display is also used. ZigBee transceiver is used for wireless communication purpose. Zigbee is based on the IEEE802.15.4 protocol. The range of ZigBee is covered up to 100m. Range of Zigbee is ten times more than that of Bluetooth, hence used Zigbee.

SYSTEM OVERVIEW

In the smart HEMS system contains two sections i.e. Transmitter & Receiver. The transmitter and receiver block diagram is shown below.

Transmitter:



Receiver:



Hardware Tools

1. ARM Microcontroller (LPC2148).
2. Solar Panel & Wind mill.
3. 12V Battery.
4. Energy meter.
5. Zigbee module.
6. 16*2 LCD display, etc.

Software Tools

1. KEIL software.
2. Embedded C.
3. Flashmagic, etc.

Applications

1. Can be used to reduce Energy cost.
2. Used to increase the power generation capacity of the nation.
3. Can be used in industrial applications.
4. Can be used on broad scale with little modifications.

CONCLUSION

The Smart home energy management system works well in real time. Solar energy and wind energy are tremendously available in nature, so there is enough production of power to supply the home appliances. The cost of the implementation is low and also the system reduces the cost of the power. To save the energy for upcoming future generations, home appliances are kept off during peak hour to maintain energy management.

Future Scope:

In Proposed Smart Home Energy Management System, we can modify the hardware for use of system on broad scale. As we can increase the Energy storage capacity (Battery size) as well as size of the solar panel and wind mill. Also we can include other renewable energy generation techniques such as Nuclear (Atomic) Energy, Geo-Thermal Energy, Tidal Energy, Hydraulic Energy, etc. By including these energy techniques we can use this system for the industrial purpose & also can be used to increase the power generation capacity.

REFERENCES

[1] Sethuraman M & S. Jayanthi, "Low cost and high efficiency Smart HEMS by using Zigbee with MPPT techniques", 'International Journal of Advanced Research in Computer Science and Software Engineering' in November 2014.

[2] M. Kuzlu, M. Pipattanasomporn & S. Rahman, "Hardware Demonstration of a Home Energy Management System for Demand Response Applications", IEEE Transactions on smart grid, Vol.3, No.4, July 2013.

[3] Alphy John & Bildass Santhosam, "Home Energy Management System Based On Zigbee", International Journal of Inventive Engineering & Sciences, ISSN: 2319-9598, Vol-2, Issue-4, March 2014.

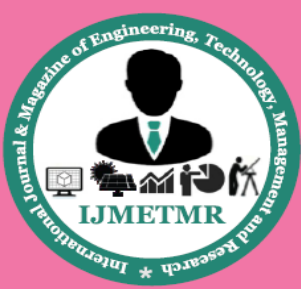
[4] Mario Collotta & Giovanni Pau, "A Novel Energy Management Approach for Smart Homes using Bluetooth Low Energy", IEEE Journal on selected areas in communications, Vol.0, NO.0, in Sept. 2015.

[5] Sunguk Lee, "Review of System Architecture and Security Issues for Smart Grid", International Journal of Advanced Science and Technology, Vol.53, Apr. 2013.

[6] Young-Sung Son & Kyeong-Deok Moon, "Home energy management system based on power line communication," in Proc. IEEE International Conference on Consumer Electronics, Las Vegas, USA, pp.115-116, Jan. 2010, IEEE Trans. Consumer Electron., vol. 56, no. 3, pp. 1380-1386, Aug. 2010

[7] Jinsoo Han, Chang-Sic Choi, Wan-Ki Park, and Ilwoo Lee, "Green home energy management system through comparison of energy usage between the same kinds of home appliances," in Proc. IEEE International Symposium on Consumer Electronics, Singapore, pp. 1-4, Jun. 2011.

[8] Chia-Hung Lien, Hsien-Chung Chen, Ying-Wen Bai, and Ming-Bo Lin, "Power monitoring and control for electric home appliances based on power line communication," in Proc. IEEE International Instrumentation and Measurement Technology Conference, British Columbia, Canada, pp. 2179-2184, May 2008.



[10] Saeed Jahdi and Loi Lei Lai, "Grid integration of wind-solar hybrid renewable using AC/DC converters as DG power sources," in Proc. World Congress Sustainable Technologies, London, UK, pp. 171-177, Nov. 2011.

[11] Hayato Yamauchi, Kosuke Uchida, and Tomonobu Senjyu, "Advanced Smart Home," in Proc. IEEE International Conference on Harmonics and Quality of Power, Hong Kong, China, pp. 130-135, Jun. 2012.

[12] Jinsoo Han, Chang-Sic Choi, Wan-Ki Park, Ilwoo Lee, and Sang-Ha Kim, "Smart home energy management system including renewable energy based on ZigBee and PLC," in Proc. IEEE International Conference on Consumer Electronics, Las Vegas, USA, pp. 544-545, Jan. 2014.

[13] Namsik Ryu, Jae-Ho Jung, and Youngchae Jeong, "High-efficiency CMOS power amplifier using uneven bias for wireless LAN application," ETRI Journal, vol. 34, no. 6, pp. 885-891, Dec. 2012.