INTERNATIONAL JOURNAL OF RESEARCH
In Advanced Engineering Technologies

Volume 4, Issue 4 AUG 2015

WIFI BASED SMART GRID TO REMOTELY MONITOR AND CONTROL RENEWABLE ENERGY SOURCES

K. SOWMYA [1], P.SRINIVAS [2]

[1]M-Tech Student, Dept Of ECE, Nalla Narasimha Reddy Group of institutions , ChowdariGuda , GhatkesarMandal , Rangareddy Dist, Telangana, India.

[2] Associate professor, Dept Of Ece Nalla Narasimha Reddy Group of institutions , ChowdariGuda , GhatkesarMandal , Rangareddy Dist, Telangana, India.

Abstract: This paper describes a Smart Grid architecture implemented with the help of Web of Things.Web of Things comprise of a set of Web services provided on top of a number of Internet enabled Embedded devices .The Web browser on any computer can act as an interface to the services provided by these Web of Things. The Embedded devices are ARM Processor based devices with Ethernet capabilities. CMSIS Real Time Operating System is used for process control on each of these embedded devices. LwIP Protocol Stack is implemented on top of each of these devices so that IP connectivity can be established. The Web interfaces provide us real time information on each of the energy meters that are installed on site and communicate to the Embedded Internet devices using MODBUS communication protocol. Real Time energy source scheduling, energy source selection, power connection and disconnection are some of the services that are provided to an on-line authenticated user. The Embedded Systems lab Infrastructure at the TIFAC CORE for 3G/4G Communication at National Institute of Science and Technology was used for the hardware testing of the embedded modules. We were greatly helped by the Software developers at NIST Technology Consultancy Services in designing the web applications and interfaces for our Web of Things architecture.

Key words: Ethernet, ARM-9, Lighting devices, Power meter, Energy Sources.

I. Introduction

Use of Renewable Energy Sources in Household electrification has always been the most effective method to minimize the amount of carbon emissions that we contribute towards the cumulative carbon emissions of this planet earth. These carbon emissions have given rise to global warming due to depletion of the ozone layer. Use of alternatives like solar water heaters helps to reduce individual carbon emission footprint upon the environment. But the use of these alternatives is location and climate dependent.

The power grid supply to our homes still remains the primary source of energy for most of the Appliances in our homes. Also the reconfiguration of the electrical circuitry of the entire home is a cumbersome process for the end user. If the users are provided with an inexpensive process to configure the power supply of their homes as per requirement, the use of generated renewable energy can be

maximized. This would eventually put an impact on the total carbon emissions due to the generation process of power from non-renewable energy sources. The Web of Things comprise of a number of Internet enabled Embedded devices which provide such an interface to the user by means of Web services. The end user can access this through a web browser of any computer with an Internet connection. This paper is organized as follows. Section is a brief description of Web of Things (WoT) solutions. It also introduces the concept of WoT. In Section, we describe how WoT applications can be implemented using hardware components. The different hardware components providing Internet connectivity, support for data acquisition from energy meters and communication within modules are described .Section presents an analysis of the Web services provided. The Web services comprise of authentication of subscriber, monitoring of power consumption from different power sources, power scheduling and graphical representation of data. Section discusses the problems faced and Section discusses the scalability and sustainability of the whole project. Finally we conclude our outcome in section .

II. The Hardware System

Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

III. Design of Proposed Hardware

Energy saving solutions has been becoming increasingly essential in recent years because of environmental issues such as climate change and global warming. Environmental problems are very important issue and these problems are largely caused by the excessive use of energy. Since the existing systems are designed without considering user satisfaction ,it is not appropriate to the places such as house and office where the user satisfaction is more crucial factor than cost benefit due to energy saving. All things considered, design goals of the new intelligent lightning control system are as follows; the new intelligent lightning control system should be designed to maximize the utilization of LED lighting. The new intelligent lightning control system should be designed to have the communication capability.

The system should be designed to both energy efficiency and user satisfaction.

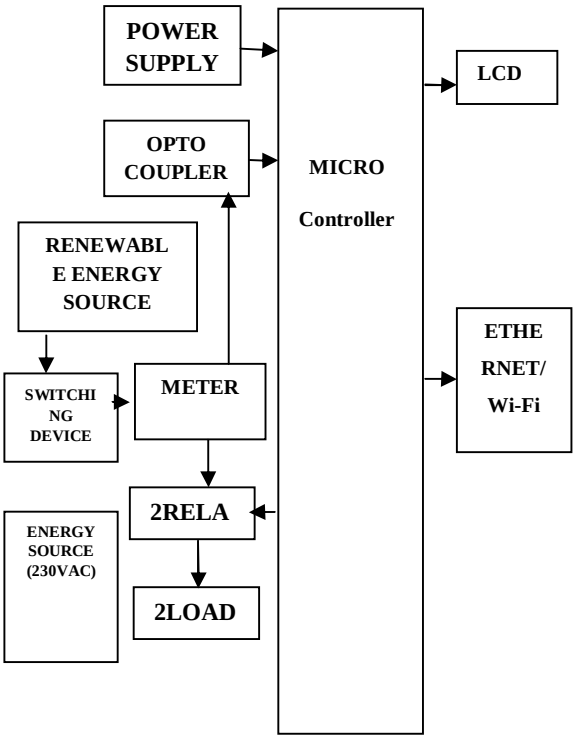

Fig. 1.Node Section

IV. Board Hardware Resources Features

Ethernet: Networking is playing vital role in current IT era where data distribution and access is critically important. As the use of communication between two or more entities increases the networking technologies need to be improved and refurbished over time. Similarly the transmission media, the heart of a network, has been changed with the time improving on the previous one. If you know a little bit about networking you surely have heard the term Ethernet which is currently the dominant network technology. Wide spread of the Ethernet technology made most of the offices, universities and buildings use the technology for establishment of local area networks (LANs).

Fig. 2.second section

To understand what actually Ethernet is, we need to know about IEEE first which is a short of Institute of Electrical and Electronics Engineers. IEEE is a part of International Organization for Standardization (ISO) whose standard IEEE 802.3 is defined for Local Area Network. The standard 802.3 commonly known as ETHERNT defines the communication standards for how data is transferred from one network device to another in a local area network. Since the limit for Ethernet cable is few hundred meters Ethernet is commonly deployed for networks lying in a single building to connect devices with close proximity. The same standard for Ethernet enables manufactures from around the earth to manufacture Ethernet products in accordance with the ISO standards that are feasible for all computing devices worldwide

In 1982 Sun Microsystems was founded to develop UNIX workstations with Ethernet. Later soon Intel introduced the first Ethernet interface card. In November 1982, the second version of ethernet was launched known as Ethernet II. Next year the 802.3

specification was formally approved by IEEE and it was adopted by ISO. Soon there were many new companies like Novell, Cabletron, CISCO, Network General, and SynOptics to develop a variety of devices for Ethernet LAN. Ethernet became the major technology in computer networking by the end of 1980's. Since then the technology is continuously evolving data speeds and reliability measures.

Optocoupler: There are many situations where signals and data need to be transferred from one system to another within a piece of electronics equipment, or from one piece of equipment to another, without making a direct electrical connection. Often this is because the source and destination are (or may be at times) at very different voltage levels, like a microcontroller which is operating from 5V DC but being used to control a triac which is switching 230V AC. In such situations the link between the two must be an isolated one, to protect the microprocessor from over voltage damage. Relays can of course provide this kind of isolation, but even small relays tend to be fairly bulky compared with ICs and many of today's other miniature circuit components. Because they are electro-mechanical, relays are also not as reliable ó and only capable of relatively low speed operation. Where small size, higher speed and greater reliability are important, a much better alternative is to use an Optocoupler. These use a beam of light to transmit the signals or data across an electrical barrier, and achieve excellent isolation.

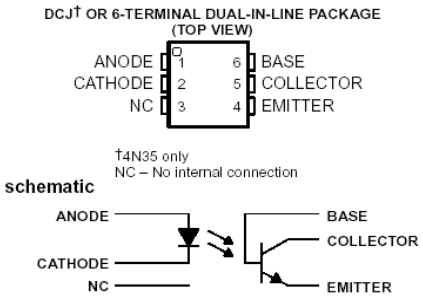

Fig. 3. Optocoupler.

ENERGY METER

This section consists of an Energy Meter. This energy meter is used for metering the power being consumed. The 230V ac is fed to the Energy meter and is again taken back from the output pins. The criterion involved is that the voltage is fed to the appliances in series with Energy meter. So whenever a device consumes some power then the power being consumed is calculated by the energy meter. And it gives a blink of LED indicating one unit of power being consumed. This indication is taken by Microcontroller through an Optocoupler. The microcontroller calculates and deducts the amount accordingly.

RELAY SECTION:

This section is nothing but driving circuitry needed to drive the Loads. So this section basically includes a Relay with its protection circuitry. This section is responsible to drive the Normal Loads and also the Emergency Loads.

V. CONCLUSION

Saving energy has become one of the most important issues these days. A light accounts for approximately

20 percent of the world's total energy consumption; thus, a lot of studies and development related to energy saving of a light have been done by various researchers all over the world. However, since there are no products considering both energy efficiency and user satisfaction, the existing systems cannot be successfully applied to home and office buildings. Therefore, we propose an intelligent household LED lighting system considering energy efficiency and user satisfaction. The proposed system utilizes multi sensors and wireless communication technology in order to control an LED light according to the user's state and the surroundings. The proposed system can autonomously adjust the minimum light intensity value to enhance both energy efficiency and user satisfaction We designed and implemented the proposed system in the test bed and measured total power consumption. The proposed lighting system reduces total power consumption of the test bed up to 21.9%.

VI. REFERENCES

[1] S. Tompros, N. Mouratidis, M. Draaijer, A. Foglar, and H. Hrasnica, "Enabling applicability ofenergy saving applications on the appliances of the home environment," IEEE Network, vol.23, no. 6, pp. 8-16, Nov.-Dec. 2009.

[2] Tao Chen, Yang Yang, Honggang Zhang, Haesik Kim, and K. Horneman, "Network energy saving technologies for green wireless access networks," IEEE Wireless Communications, vol. 18, no. 5, pp. 30-38, Oct. 2011.

[3] J. Byun and S. Park, "Development ofa self-adapting intelligent system for building energy saving and context-aware smart services," IEEE Trans. on Consumer Electron., vol. 57, no. 1, pp. 90-98, Feb. 2011.

[4] J. Han, C.-S. Choi, and I. Lee, "More efficient home energy management system based on ZigBee communication and infrared remote controls," IEEE Trans. on Consumer Electron., vol. 57, no. 1, pp. 85-89, Feb. 2011.

[5] Ç. Atıcı, T. Özçelebi, and J. J. Lukkien, "Exploring user-centered intelligent road lighting design: a road map and future research directions," IEEE Trans. on Consumer Electron., vol. 57, no. 2, pp. 788-793, May 2011.

[6] A. A. Siddiqui, A. W. Ahmad, H. K. Yang, and C. Lee, "ZigBee based energy efficient outdoor lighting control system," in Proceedings of the International Conference on Advanced Communication Technology, pp. 916-919, 2012.

[7] M.-S. Pan, L.-W. Yeh, Y.-A. Chen, Y.-H. Lin, and Y.-C. Tseng, "A WSN-Based Intelligent Light Control System Considering User Activities and Profiles," IEEE Sensors Journal, vol. 8, no. 10, pp. 1710-1721, Oct. 2008.

[8] Y. Uhm, I. Hong, G. Kim, B. Lee, and S. Park, "Design and implementation of power-aware LED light enabler with location-aware adaptive middleware and context-aware user pattern," IEEE Trans. on Consumer Electron., vol. 56, no. 1, pp. 231-239, Feb. 2010.

[9] T.-J. Park and S.-H. Hong, "Experimental CaseStudy of a BACnetBased Lighting Control System," IEEE Trans. on Automation Science and Engineering, vol. 6, no. 2, pp. 322-333, Apr. 2009.

[10] S. Matta and S. M. Mahmud, "An intelligent light control system for power saving," in Proceedings of the Annual Conference of the IEEE Industrial Electronics Society, pp. 3316-3321, 2010.

[11] F. J. Bellido-Outeirino, J. M. Flores-Arias, F. Domingo-Perez, A. Gil-deCastro, and A. Moreno-Munoz, "Building lighting automation through the integration of DALI with wireless sensor networks," IEEE Trans. on Consumer Electron., vol. 58, no. 1, pp. 47-52, Feb. 2012.

[12] F. Leccese, "Remote-Control System of High Efficiency and Intelligent Street Lighting Using a ZigBee Network of Devices and Sensors,"IEEE Trans. on Power Delivery, vol. 28, no. 1, pp. 21-28, Jan. 2013.

[13] D. T. Delaney, G. M. P. O'Hare, and A. G. Ruzzelli, "Evaluation of energy-efficiency in lighting systems using sensor networks," in Proceedings of the First ACM Workshop on Embedded Sensing Systems for Energy-Efficiency in Buildings, pp. 61-66, 2009

[14] G. W. Denardin, C. H. Barriquello, R. A. Pinto, M. F. Silva, A. Campos, and R. N. do Prado, "An Intelligent System for Street Lighting Control and Measurement," in Proceedings of the IEEE Industry Applications Society Annual Meeting, pp. 1-5, 2009.