ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Special Issue 6, July 2017

Smart Home Automation using Renewable Energy

Bipani Sharma[1], Dr. V.G. Supriya[2]

P.G. Student, Department of Electronics and Communication Engineering,K.S. Institute of Technology, Raghuvanahalli, Bangalore, India[1]

Associate Professor, Department of Electronics and Communication Engineering,K.S. Institute of Technology, Raghuvanahalli, Bangalore, India[2]

ABSTRACT:This paper aims at designing a smart energy management system, where renewable energies are smartly managed using LPC 2148 microcontroller which is used by the home appliances. Renewable energies are generated using solar panels and wind turbines. The generated energy is then stored in the battery, which is further connected to an inverter. This energy is used for home appliances. If energy consumption of house appliances increases more than the energy generated by renewable sources, some of the appliances are switched automatically to KEB energy through grid and details of amount of energy consumed from KEB is sent to concerned person through ZigBee and cloud.

KEYWORDS:LPC 2148 Microcontroller, Power supply, ZigBee,Battery, Inverter

I. INTRODUCTION

As the demand of Electricity has been increasing from back few years, as a result of this more serious problems have been faced by the electrical power system. The consumption of electrical energy in both residential and commercial sectors gives rise to global energy crises and leads to environmental problems. In general, in home and residence premises, increasing in the number of appliances day by day, cause in energy consumption more. In generation of electricity renewable energy sources plays an important role. There are various renewable energies like wind, solar, geothermal, ocean thermal and biomass which can be used for generation of electricity to fulfill our daily needs. The best option is solar energy for generation of electricity as it is available everywhere and is free. On an average in India the sun shines for about 6 hours annually and 9 months in a year.

There alreadyexist smart home energy management systems. In[1], it decreases the consumption of home power which is based on power lines communication and provide easy-to-access to home energy consumption. Here the work is interpreted as a device control module to handle networked home appliances, but it doesn't consider the consumption of energy.

In[2], to manage the energy in an effective and efficient way, it deployed solar and wind power system so that it can enhance the smart home but this work considers only renewable resources and not considering the energy consumption by the appliances.

In[3], it explains the home energy management system and its was implemented using power line communication. In this HEMS monitors smart meter and make a plan to control the appliances related to energy remotely from internet providing auto-configuration, remote monitoring, energy management, plausible controlling. Especially, planning makes to shift devices controlling on peak prices time and to smooth power demand work load. The disadvantage of this project is renewable energy is not considered.

In [4], the renewable energy sources are installed in residential area to save the energy cost, which it is important for both energy consumption and generation and simultaneously considered in HEMS. The smart HEMS architecture is considered for both consumption and generation. In the energyconsumption, the EMCUs are installed in outlets and lights to measure the energy usage of home appliances. The ZigBee is used to transfer the gathered data to the home server figures out the home energy usage pattern. In the energy generation, PLC modem are installed in each solar

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Special Issue 6, July 2017

panel to monitor its status and maintenance. Using the obtained energy information, the home server can control the home energy which is used to schedule and minimize the energy cost. The REMS provides the comparison and analysis for home energy usage and seems to be effective.

Therefore, to reduce the immense use of energy use of energy, there two main things considered, first energy saving and second renewable energies, as a result both energy consumption and generation is done simultaneously. Researchers have developed many equipments to reduce the use of the electrical energy by using renewable energies like wind and solar energies etc. And their work and idea helped in many field. renewable energy and energy consumption, these made [HEMS] Out of some existing technologies, which focus only the generation of energy, not considering technology to come in existence. In this project, both the energy generation by the solar cell and wind turbine and energy consumption of home appliance is considered, where the information is directly send to the microcontroller. And using IOT technology user can get the information about the usage of energy.

This paper is intended to implement Smart Management of Energy System using Renewable Energy based on ZigBee. The paper is organized as follows. Section II describes the proposed HEMS architecture in detail. Section III describes several implementation and functionality of each block in HEMS in detail. Section IV shows the results for the architecture. Finally, section V concludes this paper.

II. ARCHITECTURE OF PROPOSED SYSTEM

A. System architecture:

There are many efforts are taken for energy efficient home appliances [5]-[8], by using energy management system we can achieve more energy energy-efficient home. A new architecture for energy –efficient home is proposed. In this project two parts concerning energy: consumption and generation. In energy consumption part numerous home appliances and light are present and in energy generation part renewable energies such as solar and wind energies are present. As home consumes and generates energy, control devices like a home server needs to monitor and control both energy consumption and energy generation to minimize the energy cost.

Fig.1. Shows the architecture of the proposed method which considered energy-consuming home appliances and lights and energy-generation solar and wind energy resources. In the energy consumption part, the energy consumed by the home appliances and lights is monitored through a current sensor that is installed in each outlet and each light and home appliances. The current sensor measures the energy and current consumption of home appliances and lights; it transfers the measured values to the home server. Home server gathers the energy consumption information from the outlet of home appliances and analyzes the gathered dataand makes the energy usage profile of home appliances and light. Home server calculates and compares with threshold value.

In energy generation part, the energy is generated and the generated energy is stored in battery. Battery is further connected to home server to update the status. Battery is connected to inverter which convert DC to AC because current generated by battery is in form of DC and home appliances works on AC. As the AC current is generated is fed to the appliances.

B. Home server:

The home server manages the current sensor installed in outlets of home appliances and light. The home server monitors and controls the current sensor through the node grid block. The device table manages both home appliances and lights connected to the current sensor. The home server identifies home appliances and lights using this grid. The energy consumption data of home appliances and lights are stored in the information database. In home server initially threshold value is set; it compares the threshold with consumed energy. If the consumed current value is less than threshold then appliances will work, if the consumed value is more than threshold then that particular appliance will be connected to KEB. To connect with KEB relay switches play an important role.

III. IMPLEMENTATION

The block diagram of the proposed smart management of energy system is shown in Fig.1.Themeaningandfunctionality of each block with respect to the labels mentioned in the figure is as follows:

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Special Issue 6, July 2017

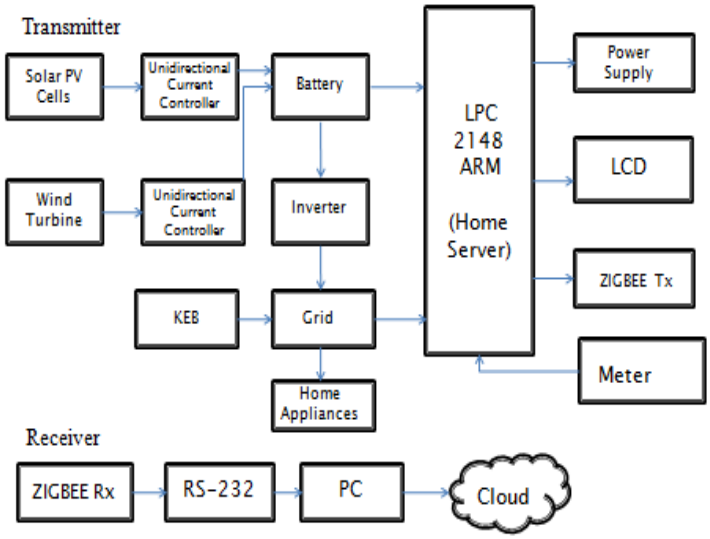


Fig. 1. Proposed Smart Energy Management System

A. Solar panel:

Solar cells or solar panels are photo voltaic cells which convert sunlight into electricity.A photovoltaic cell comprises P-type and N-type semiconductors with different electrical properties, joined together. The joint between these two semiconductors is called the "P-N junction." Sunlight striking the photovoltaic cell is absorbed by the cell. The energy of the absorbed light generates particles with positive or negative charge (holes and electrons), which move about or shift freely in all directions within the cell. The electrons (-) tend to collect in the N-type semiconductor, and the holes (+) in the P-type semiconductor. Therefore, when an external load, such as and electric bulb or an electric motor, is connected between the front and back electrodes, electricity flows in the cell.

B. Wind turbine:

Wind turbines convert kinetic energy from the wind that passes over the rotors into electricity. The kinetic energy in the wind turns two or three propeller-like blades around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity. Wind turbines are mounted on a tower to capture the most energy. At 100 feet (30 meters) or more above ground, they can take advantage of faster and less turbulent wind. turbines can be used to produce electricity for a single home or building, or they can be connected to an electricity grid for more

widespread electricity distribution. Wind turbines harness the power of the wind and use it to generate electricity. Simply stated, a wind turbine works the opposite of a fan. Instead of using electricity to make wind, like a fan, wind turbines use wind to make electricity.

C. Unidirectional diode:

These are normal p-n junction diodes, which allow the current to flow in a particular direction and restrict the flow of current in its opposite direction.

D. Inverter:

It is connected to 12V battery and which converts DC current to AC current. As home appliances and light requires AC current to operate.

E. Relay:

One-channel relay board which operates on 5-6 V is used here. The circuit is used to switch from renewable energy to KEB. There are three pins on the relay board namely normally open(NO), normally closed(NC) and common (C). The common pin is connected to NC pin when the relay is off, which is connected to inverter and to the NO pin when the relay is on. The input pin “INP” receives logic high from microcontroller and in turn switches on the relay, thus

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Special Issue 6, July 2017

common is connected to NO switch turns the device connected to KEB. The “VCC” and “GND” pins of the relay are connected to 5V supply and ground respectively.

F. Power Supply:
The device to be switched, here, is microcontroller which runs on 3.3V supply and meter. It’s one end is connected to the 240V AC supply and the other end is connected to NO pin of their lay board.

G. Grid:
In grid as shown in Fig 2. from inverter two bulbs are connected through current sensor and from another bulb one more current sensor is connected. When first bulb is switched on current sensor detects the amount of current consumed by the bulb and send the information to home server(microcontroller). In microcontroller initially threshold value is fed, as soon as the microcontroller receive the information it compares with threshold value, if the consumed current value is less than threshold bulb will glow without any interrupt. When second bulb switched on, again current sensor detects the amount consumed by both the bulb and send the information to microcontroller, microcontroller compares the values with threshold, if the value less than the threshold value both bulbs glow. As soon as the third bulb switched on again current sensor detects the amount of consumed current by all the three bulbs and send the information to microcontroller, microcontroller again compares with the threshold value, if the value counts less than threshold value the all the three bulbs glow without interrupt but if the value counts more than threshold then the particular bulbwill be connected to KEB and the rest of the two bulbs glows on renewable energies. The process of switching from renewable energy to KEB is done by relay circuit.

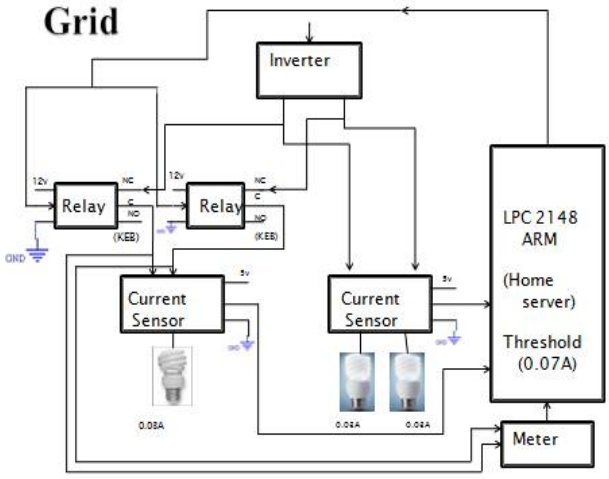


Fig. 2. Block Diagram of GRID

H. Current Sensor:
This current sensor is a device that detects and converts current to an easily measured output voltage, which is proportional to the current through the measured path.

I. LCD:
It used to display the amount of power consumed by the home appliances. As it is connected to microcontroller, all the information is transfer through microcontroller.
J. Home appliances:
Here in this project three bulbs are used to indicate the home appliances which require AC to operate. Each bulb is of 0.03 Amps.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

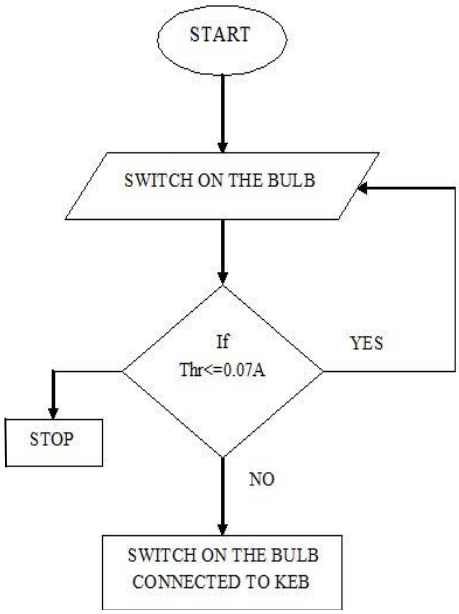
Website: www.ijircce.com

Vol. 5, Special Issue 6, July 2017

K. ZigBee:
ZigBee is the name of a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2006 standard for wireless personal area networks (WPANs), such as wireless headphones connecting with cell phones via short. range radio. Here it is used for sending the consumed power by home appliances to the user wirelessly.

L. Microcontroller:
The LPC2141/42/44/46/48 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Here it is use to control the energy generation and consumption part, which help to use energy in a controlled way.

M. Meter:
It is a normal digital meter which gives the reading for power consumption. Meter comes into picture as soon as the particular home appliance is connected to the KEB.



Flowchart 1. Smart Energy Management System

IV. RESULTS

The implemented result shows the installation having LPC 2148 microcontroller, current sensor, 3 bulbs, relays, solar panel, wind turbine and an inverter as shown in Fig 3. Here 0.03 Amp bulbs are used. The experiment was performed to check the amount of energy saved by using renewable energies and also to check the amount of energy used by a particular load which is connected to the KEB, as because if the amount of current consumption is more than threshold.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Special Issue 6, July 2017

Fig. 3. Smart Energy System Installation

The usage of KEB power, is sent by the microcontroller through ZigBee to Receiver's cloud and the user will receive a SMS or an email as "LOAD RUNNING USING KEB" and after every five counts "3 watt-hours" is consumed and increases subsequently.

TABLE 1 IMPLEMENTATION RESULTS

	Load			Threshold	Consumption	Source
	Bulb 1 (0.03 A)	Bulb 2 (0.03 A)	Bulb 3 (0.03 A)			
Case 1	ON	OFF	OFF	0.07 A	0.03 A	Renewable Energy
Case 2	ON	ON	OFF	0.07 A	0.06 A	Renewable Energy
Case 3	ON	ON	ON	0.07 A	0.09 A	KEB Supply

V. CONCLUSION

This paper describes the smart management of energy in home using ZigBee. For supporting energy management services, it monitors smart meter and make a plan to control the appliances related to energy remotely from internet providing auto-configuration, the main advantage is it uses renewable energies and if any appliances require more power and renewable energies can't satisfy the requirement the it automatically switches to KEB. Finally, it can deliver clear benefits about resource utilization, energy conservation and cost reduction to users.

REFERENCES

[1] Young-Sung Son and Kyeong-Deok Moon, "Home energy management system based on power line communication," IEEE Trans. Consumer Electron., vol. 56, no. 3, pp. 1380-1386, Aug. 2010.
[2] 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.
[3] Young-Sung Son, TopiPulkkinen, Kyeong-Deok Moon and ChaekyuKim," Home Energy Management System based on Power Line Communication",IEEE Transactions on Consumer Electronics, Vol. 56, No. 3, August 2010.
[4] 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 IEEE Transactions on Consumer Electronics, Vol. 60, No. 2, May 2014.
[5] NamsikRyu, Jae-Ho Jung, and YoungchaeJeong, "High-efficiency CMOS power amplifier using uneven bias for wireless LAN application," ETRI Journal, vol. 34, no. 6, pp. 885-891, Dec. 2012.
[6] C. Arm, S. Gyger, J. Masgonty, M. Morgan, J. Nagel, C. Piguet, F. Rampogna, P. Volet, "Low-power 32-bit dual_MAC 120 uW/MHz 1.0Vicyflex1 DSP/MCU core," IEEE Journal of Solid-State Circuits, vol. 44, no. 7, pp. 2055-2064, Jul. 2009.
[7] Hyoungsik Nam and HoonJeong, "Data supply voltage reductionscheme for low-power AMOLED displays," ETRI Journal, vol. 34, no. 5,pp. 727-733, Oct. 2012
[8] Hyunho Park and Hyeong Ho Lee, "Smart WLAN discovery for powersaving of dual-mode terminals," ETRI Journal, vol.35, no.6,pp.1144-1147, Dec. 2013.