ZIGBEE BASED HIGH EFFICIENT SMART METERING SYSTEM

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Abstract:

Home power consumption tends to grow in proportion to increase in the number of large-sized electric home appliances. Hence home energy management system (HEMS) needs to consider both energy consumption and generation of electricity. This paper proposes a smart HEMS architecture using renewable energies. The current energy crisis has required significant energy reduction in all areas but energy consumption has been increased in home areas due to more home appliances installed. Home energy problems are solved by using renewable energy sources and energy saving method. PIC microcontroller can be used to monitor and control the energy generation from renewable energies such as solar panel, wind turbine. Zigbee used for the measurement of energy consumption from home appliances. The efficiency of power generation can be increased by using Maximum Power Point Tracking (MPPT) techniques and power saving can be done using stand alone cut off technique. The energy consumption of home appliances and generation of renewable energies are collected from home server which is used for analyzing the total energy estimation and control the energy consumption in home to minimize the energy cost.

1. INTRODUCTION

In our today world most considerable one is energy saving and generation by build Smart home energy management system for consider in home areas. Particularly the energy can be saved from home and industrial appliances are undergone more often than not. Smart home energy management system is used to save the energy from home appliances by using solar panel and wind turbine. Today day to day life people are using internet so it helps this paper to know the generation and consumption of energy. PIC microcontroller can be used here as to obtain the low cost and MPPT technique can be used to achieve high efficiency in energy generation. Current sensor can used to measure the current consumption from home appliances and generation from renewable energies. Several electric appliances are such as iron box, TV or microwave oven is running and it can be automatically cut off when no one is present in the place by using PIR sensor. Subsequently PIC controller should be interface with mobile devices or PC or Laptop to know the details such as generation of renewable energies and consumption of home appliance details with the help of internet server.

2. SMART HOME ENERGY MANAGEMENT SYSTEM

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.   Mostly Smart HEMS architectures are prepared by using the renewable energies and PLC controller. The energy readings are taken by the smart meter sometimes they preferred digital meters. This be prepared the smart home energy management system implementation

cost is higher as PLC controller is cost wise higher than embedded controllers reminiscent of 8051, PIC, ARM.   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. One of the far and wide used techniques is internet. 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.   A system via the Global System for Mobile communications (GSM) and Internet was proposed for real-time monitoring and remote control in home appliances to display the energy readings. These add flexibility for the implemented system, but, it increases the cost when using GSM technology. The designing system also exploits Internet for monitor the home energy also from outside.
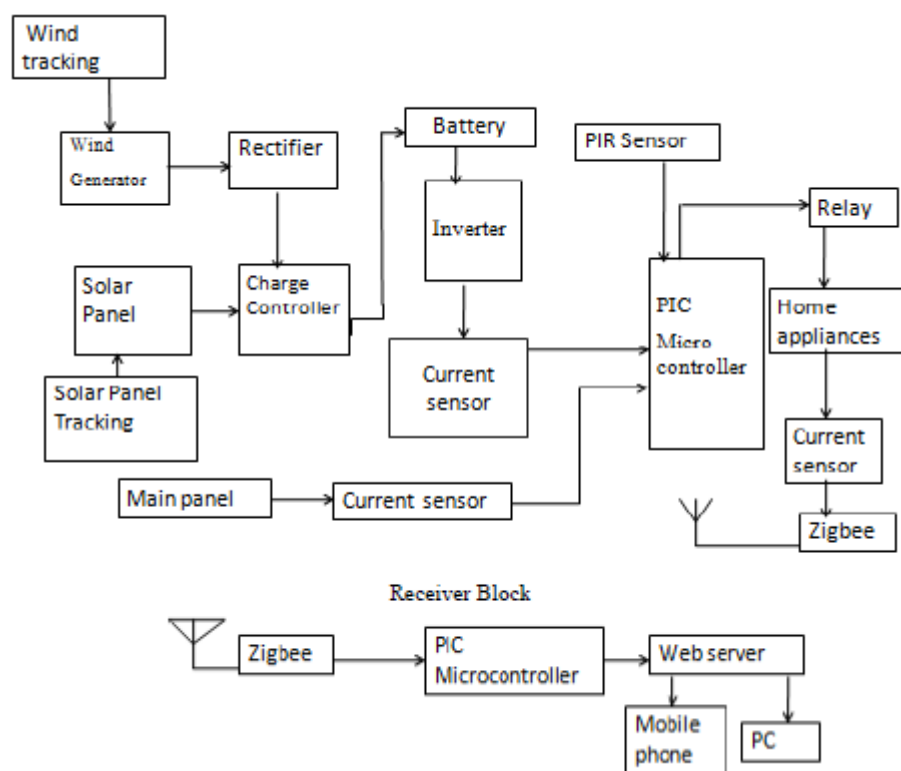
3.   GENERAL ARCHITECTURE

Fig.1.General block diagram

Solar Panel with MPPT: A solar panel is consists of many Photo voltaic cells. It used to absorb the sun rays at day time and take a backup for use it night time. In today world the usage of the solar panel is very high to reduce the power consumption. To increasing the power generation in solar panel by using Maximum Power Point Tracking Technique. This technique can be simply done by using two LDR and a DC motor.

Wind turbine with MPPT: Wind turbine is used to absorb the wind from atmosphere and using the kinetic energy from wind to generate the electrical power. Here also employed the MPPT technique to increase the power generation from wind by using peak detection method. Battery with Charge controller: Here 12v battery can be used to store the power from wind turbine and

solar panel. Both can produce above ranges then it can be controlled by using Charge controller circuit. Here a NPN transistor should be used to provide the safety purpose for drive the power from renewable energy to battery supply and maintain to don't send the power from battery to renewable energy sources such as solar panel and wind turbine.

Inverter: It can be used to convert the 12v to 230v supply for providing the power to the home appliances form solar and wind. Step up transformer can be used to increase the power from 12v– 230v power supply.

Current Sensor: Current sensor is a device used to sense the current from solar panel, wind turbine and main panel for knowing the power generation and consumption by home appliances. This current sensor is worked based on the principle of Hall Effect. To convert the current into power by using the P=VI formula. It is also possible to measure the DC and ac supply directly from the source.

PIR sensor: PIR sensor is used to sense the presence of the human being in a particular place. If there is no human being is present all the power is switched off otherwise power is switched on. The PIR can sense is based on the photo cell. So it should be worked as differently in during day and night time. In day time photo cell based sensor save the electricity through disable the lighting load which is connect to the sensor. For the duration of night time lighting load is enabled and turned on by using adjusting luminosity knob (LUX). This adjustable time knob provides an opportunity to you for staying the light on after activation.

Relay: Relay is an electrical device used to switching device for change the contact automatically. It have consist of a coil it will be generated the magnetic field for helps to change the contacts. In relay there are two operating mode NO and NC.

Zigbee: It is the wireless device for transmitting and receiving purpose or simply it called as Transceiver. Zigbee is based on the IEEE802.15.4 protocol. The range of the Zigbee is covered as 100m. It range is 10 times better than bluetooth device so it can be more preferable one in wireless device. The data rate is very low for transmission while using this device.

4. WORKING PRINCIPLE

PIR sensor is interface with the PIC 16f877a micro controller. The PIC 16f877a controller is programmed with MPLAB. When PIR is turned on, then entire electrical home appliances in building is off that means power save mode on and display PIR on and no human being is detected in the home. If PIR is turned off, then electrical home appliances are start working as before and it sends a message to the internet like PIR is turned on and Human presence in the home. So it makes easy to viewer if there is any body present in his/her building or home. The efficiency of the power generation could be increased by using MPPT techniques such as incremental conductance for solar panel and peak tracking for wind turbine. Especially in solar the power can be increased by using two LDR sensors and a DC motor. The LDR sensors are connected at top of the solar panel and the resistance changes according to the sun scorching direction by rotate the solar panel using DC motor. In wind tracking, the peak of the blade can be tracked for increase the power generation by wind. The wind and solar panel is connected to the battery according with the help of charge controller. The charge controller makes the suitable 12v for charge the battery. The battery can be charged with the help of those energies, once it charged and supply the power to the home appliances by these energies. If there is enough supply voltage is produced then this operation could be done. Otherwise the battery supply voltage is not enough then taking the main supply for providing the power to those home appliances. The switching of the power supplies are done by using
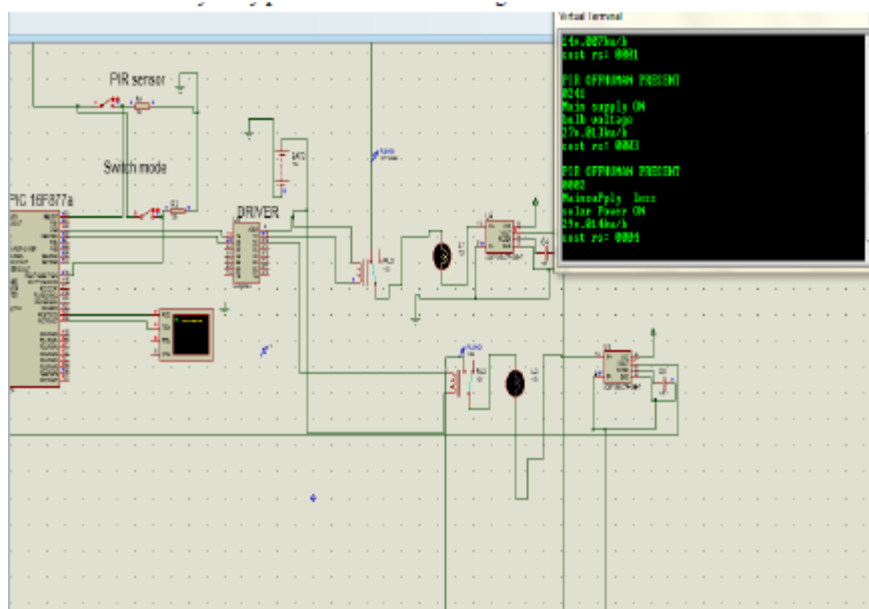
Fig.2.Working principle

relays. At the same time the power generation from solar, wind and power consumption by home appliances are calculated and displayed in the web server.

CONCLUSION

Here in thesis the smart home energy management system using PIC controller is developed. This home energy management system is works well on real time. The system can be fully controlled by controller and it can also controlled by computer using a RS232 interface. Power generation and consumption details are successfully upload into the web server continuously without interpreting other servers. Solar power and wind is enough for supply the home appliances but in addition main panel are also connected. Anyway the implementation cost of the system is low and this System is also reducing the cost of the power. During peak hour the heavy load home appliances kept off to maintain the energy management and save the energy for nature and upcoming future generations.

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