

Smart Home Energy Management System Including Renewable Energy Based on Zigbee

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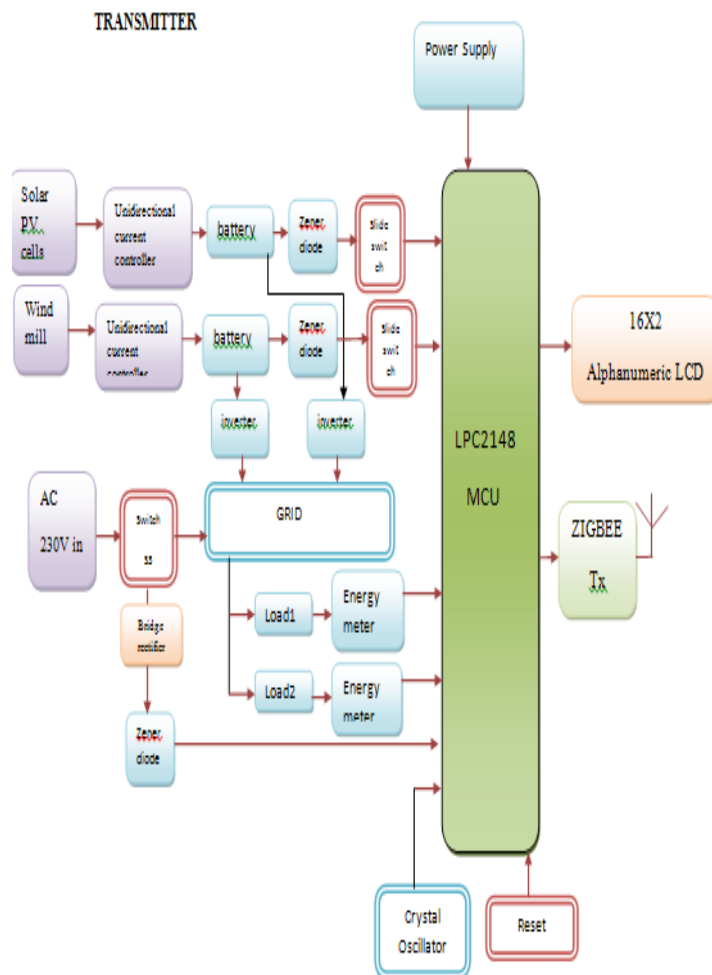
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ABSTRACT:

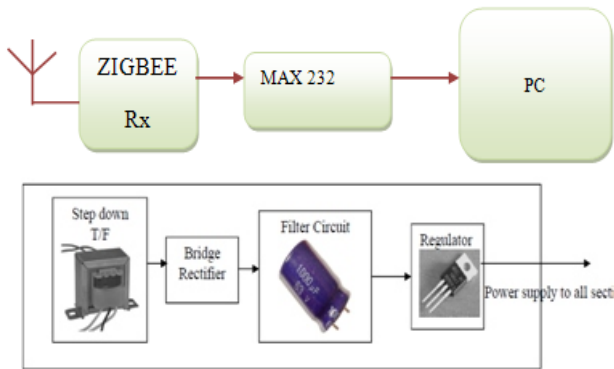
In this application we can generate the energy using renewable energy sources one is by using solar energy, another one is wind mill and one more the optional source is conventional power. These energy sources we are connecting to the grid via battery and inverter, Parallely the battery output is connected 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. This project uses regulated 3.3V, 750mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

Block Diagram:



RECEIVER:



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 has required significant energy reduction in all areas. The energy consumption in home areas has increased as more home appliances are installed. Energy saving and renewable energy sources are considered as methods of solving home energy problem. Both energy consumption and generation should be simultaneously considered to save the home energy cost.

Solar Panel:

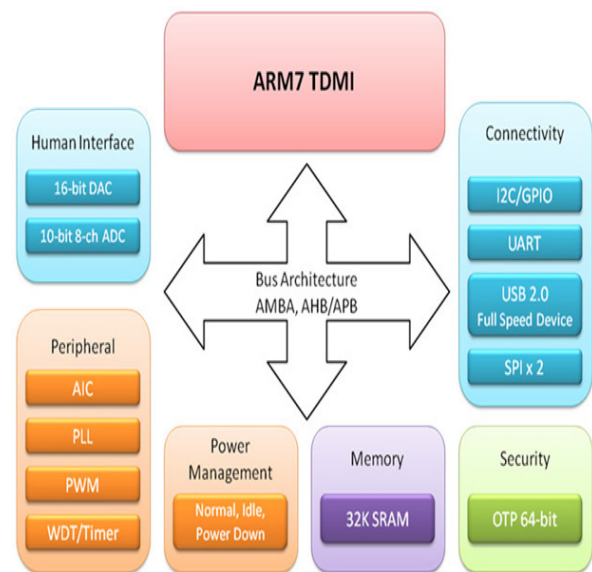
A solar panel is consists of many Photo voltaic cells. It used to absorb the sun rays at day time and take a backup for use it night time. In today world the usage of the solar panel is very high to reduce the power consumption. To increasing the power generation in solar panel by using Maximum Power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

Wind turbine:

Wind turbine is used to absorb the wind from atmosphere and using the kinetic energy from wind to generate the electrical power. 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.

ARM PROCESSOR:



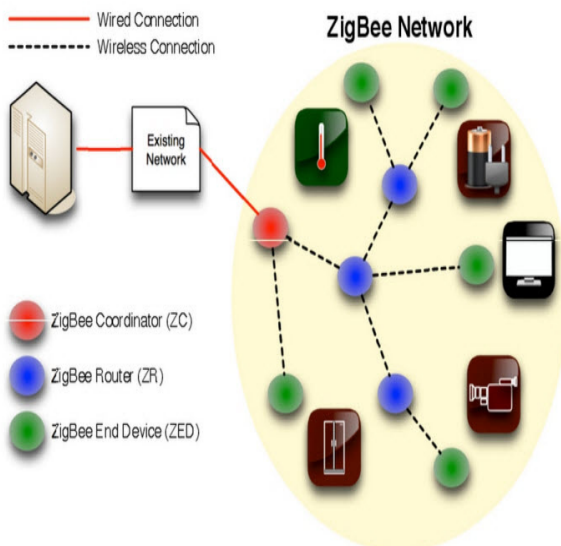
ARM7TDMI Processor Core

- Current low-end ARM core for applications like digital mobile phones
- TDMI
- oT: Thumb, 16-bit compressed instruction set
- oD: on-chip Debug support, enabling the processor to halt in response to a debug request
- oM: enhanced Multiplier, yield a full 64-bit result, high performance

ol: Embedded ICE hardware

- Von Neumann architecture

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. The communication block supports data transfer. It adopts ZigBee and IEEE 802.15.4 wireless personal area network (WPAN) as communication methods. It transfers not only the measured energy, power, and power factor but also the voltage and current.



The MCU in the communication block controls the state of the power control block in response to the command from the home server.

| | | | | |
|----------------|---------------|-----------------|-----------------|----------------------|
| Energy (4B) | Power (3B) | Voltage (3B) | Current (3B) | Power Factor (2B) |
|----------------|---------------|-----------------|-----------------|----------------------|

Data transfer message format in a ZigBee payload

Technical Specifications of Zigbee

- Frequency band 2.400 — 2.483 GHz
- Number of channels 16
- Data rate 250 kbps

- Supply voltage 1.8 – 3.6 V

- Flash memory 128 kB

- RAM 8 kB

- EEPROM 4 kB Operating

- Temperature -40 — +85 °C

LIQUID CRYSTAL DISPLAY:

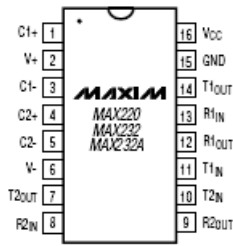
LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1. The declining prices of LCDs.
2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
4. Ease of programming for characters and graphics.

These components are “specialized” for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.



Max232 IC is a specialized circuit which makes standard voltages as required by RS232 standards. This IC provides best noise rejection and very reliable against discharges and short circuits. MAX232 IC chips are commonly referred to as line drivers.



To ensure data transfer between PC and microcontroller, the baud rate and voltage levels of Microcontroller and PC should be the same. The voltage levels of microcontroller are logic 1 and logic 0 i.e., logic 1 is +5V and logic 0 is 0V. But for PC, RS232 voltage levels are considered and they are: logic 1 is taken as -3V to -25V and logic 0 as +3V to +25V. So, in order to equal these voltage levels, MAX232 IC is used. Thus this IC converts RS232 voltage levels to microcontroller voltage levels and vice versa.

APPLICATIONS :

1. Energy cost can be reduced
2. Increase the power generation
3. Energy Monitoring
4. Know the cost of energy usage

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