International Journal of Innovative Research and Advanced Studies (IJIRAS)
Volume 2 Issue 3, March 2015

ISSN: 2394-4404

# Smart Energy Saving System Based On Standby Power Reduction

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***Abstract:*** ***Energy saving has attracted great attention as a global issue because of recent environmental problems. As more and more home appliances and consumer electronics are deployed, power consumption in home area tends to grow. Although advanced integrated circuit (IC) chipset and hardware technology enhances the power efficiency of home appliances and consumer electronics, the current energy crisis and greenhouse effect require more efficient energy management in all areas. The standby power contributes about 15 percentage of the power consumption, thus it is important to reduce the same. We present a smart energy saving system to solve these problem. Our proposed system controls the standby power of household appliances. The smart energy saving system simultaneously minimizes standby power and user's inconveniences. This system considers user behavior with help of RF transmitter. We expect the proposed system reduces total power consumption up to 10.5 percentage.***

***Keywords: smart energy saving system, Standby power reduction, PIC, RF module, PIR sensor***



## I. INTRODUCTION

Most of our electricity production is focused on fossil fuels, which are fast deputing. Along with that to use one unit of electricity two unit must be generated thus energy conservation has got significant in our day to day life. The manufactures are trying to reduce dynamic power consumption. But a considerable amount of electric energy is wasted in standby mode this wastage must be prevented. This will reduce the energy consumption. We present a smart energy saving system to solve these problems. Our proposed system controls the standby power of household appliances.

This method simultaneously minimizes standby power and user's inconveniences. We expect the proposed system reduces total power consumption up to 10.5 percent.

## II. WORKING

Our proposed system controls the standby power of household appliances. This method simultaneously minimizes standby power and user's inconveniences. The block diagram of "Smart Energy Saving System" is shown below.

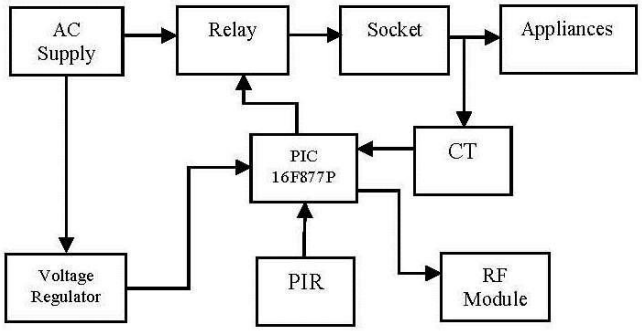


*Figure 1: Hardware block diagram*

The 230 volt AC supply is given to appliance through a relay circuit. Whenever the appliance is in standby mode for more than specified time, PIC micro controller actuate relay and the device is turned off. The mode of device is communicate with other device with help of RF module. The human interaction is consider using a PIR sensor. The 5 volt supply to micro controller is provided using LM7805 voltage regulator. If electrical power of an appliance goes below threshold value, it is taken as standby mode. When the micro-controller detects the threshold value, then it checks the user's presence by passive infrared sensors. If the micro-controller cannot detect the presence of user for a short time, it turns off the appliance. Otherwise the micro-controller waits for user's interaction with appliance for some time. If the micro-controller cannot detect users interaction, and then it turns off the appliance.

ISSN: 2394-4404

Fig.2 shows a flowchart of cutting off the standby power and returning to standby mode.

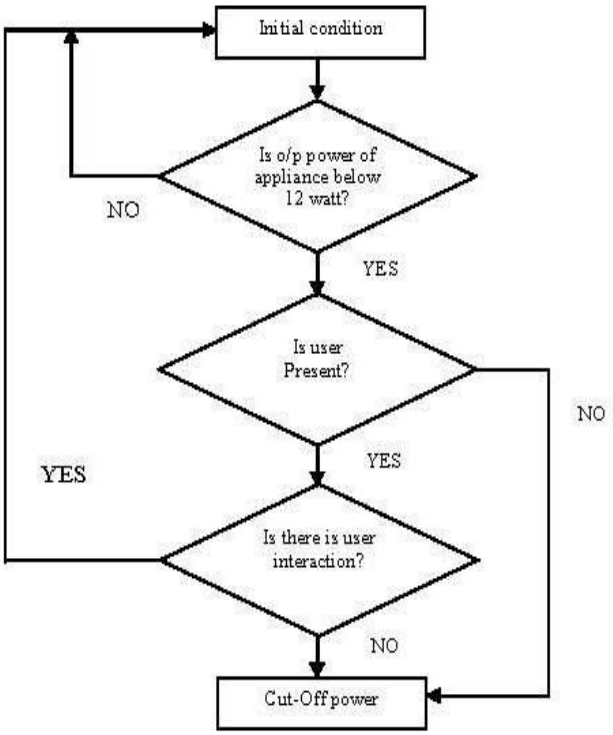


*Figure 2: Flow Chart of standby power reduction*

## III. CIRCUIT DIAGRAM

An overall idea about the working of the system can be learned from the block diagram.

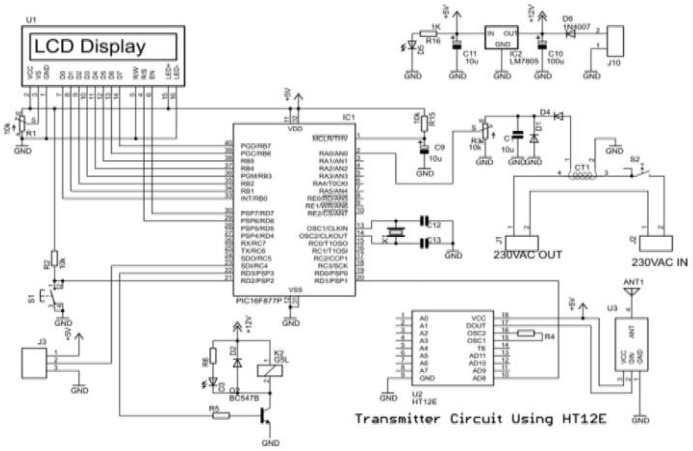


*Figure 3: Circuit Diagram*

We designed circuit for each section of the block diagram, tested individually and then combined it to a single system. The 230V supply comes to the socket through a current transformer. The output of CT is analog voltage signal which is filtered and then applied to the analog pin of PIC. Microcontroller converts this analog voltage into digital signal (high or low).This digital output is given to the relay which in turn controls the switching action. PIR sensor connected the PIC is turned on when the digital output is high. A simple LM7805 voltage regulator provides constant 5V supply to the microcontroller.

The LCD display is provided to the give the status of connected device that whether it is in active mode or in passive mode. A transmitter circuit is framed using HT12E to implement co-relation between devices. Certain devices are needed only when a specific device is in use(Active Mode).When the main device is turn off from standby mode, RF signals are transmitted from main socket. The sub socket contains a receiver circuit which causes the related devices to be turned off. The range of PIR should be adjusted so that the system works properly.

## IV. HARDWARE

### A. MICROCONTROLLER PIC 16 F877P

PIC is a family of modified Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1650. Originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to Peripheral Interface Controller. The hardware capabilities of PIC devices range from 8-pin DIP chips up to 100-pin SMD chips, with discrete I/O pins, ADC and DAC modules, and communications ports such as UART, I2C, CAN, and even USB. Low-power and high-speed variations exist for many types. PICs have a set of registers that function as general-purpose RAM. Special-purpose control registers for on-chip hardware resources are also mapped into the data space. PIC's instructions vary from about 35 instructions for the low-end PICs to over 80 instructions for the high-end PICs. The instruction set includes instructions to perform a variety of operations on registers directly, the accumulator and a literal constant or the accumulator and a register, as well as for conditional execution, and program branching.

### B. 16X2 CHARACTER LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical, easily programmable, have no limitation of displaying special and even custom characters (unlike in seven segments), animations and so on. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

### C. RF TRANSCEIVER MODULE

An RF module (radio frequency module) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices. RF modules are widely used in electronic design owing to the difficulty of designing radio

circuitry. Good electronic radio design is notoriously complex because of the sensitivity of radio circuits and the accuracy of components and layouts required to achieve operation on a specific frequency. An RF Transceiver module incorporates both a transmitter and receiver. The circuit is typically designed for Halfduplex operation, although Full duplex modules are available, typically at a higher cost due to the added complexity. As with any other radio-frequency device, the performance of an RF module will depend on a number of factors. For example, by increasing the transmitter power, a larger communication distance will be achieved. Correspondingly, increasing the receiver sensitivity will also increase the effective communication range, but will also potentially cause malfunction due to interference with other RF devices.

D. ENCODER/ DECODER IC(HT12E)

HT12E is an encoder integrated circuit of 212 series of encoders. They are paired with 212 series of decoders for use in remote control system applications. It is mainly used in interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data format. Simply put, HT12E converts the parallel inputs into serial output. It encodes the 12 bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 data bits. HT12E has a transmission enable pin which is active low. When a trigger signal is received on TE pin, the programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium HT12E begins a 4word transmission cycle upon receipt of a transmission enable. This cycle is repeated as long as TE is kept low. As soon as TE returns to high, the encoder output completes its final cycle and then stops.

E. PIR SENSOR

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used n PIR based motion detectors. All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation is invisible to the human eye because it radiates at infrared wavelengths, built can be detected by electronic devices designed for such a purpose. Here in this paper this sensor which detects the presence of the human and maintain the power control of the room.

## V. SOFTWARE

A. FLOWCODE V5

The programming is done using flowcode software. Flowcode is a development environment commercially produced by Matrix Multimedia for programming embedded devices such as PIC, AVR (including Arduino) and ARM using flowcharts instead of a textual programming language. It is currently in its sixth revision. Flowcode is a high level programming language dedicated to simplifying complex functionality such as Bluetooth, Mobile Phones Communications, and USB etc. by using dedicated component libraries of functions. Flowcode is therefore ideal for speeding up software development times and allowing those with little programming experience to get started and help with projects. Flowcode is flowchart based and components are simply dragged onto a chart before the program is compiled. Flow code software is used to program PIC micro-controller. It resembles to a flowchart and is similar to logic of flowchart.

B. EAGLE

EAGLE (for: Easily Applicable Graphical Layout Editor), by CadSoft Computer is a flexible, expandable and scriptable EDA application with schematic capture editor, PCB layout editor, auto-router and CAM and BOM tools developed by CadSoft Computer GmbH, Germany, since 1988. EAGLE contains a schematic editor, for designing circuit diagrams. Parts can be placed on many sheets and connected together through ports.

C. PROTEUS

The Proteus Design Suite is wholly unique in offering the ability to co-simulate both high and low-level microcontroller code in the context of a mixed-mode SPICE circuit simulation. With this Virtual System Modeling facility, you can transform your product design cycle, reaping huge rewards in terms of reduced time to market and lower costs of development. Proteus Virtual System Modeling (VSM) combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs. For the first time ever, it is possible to develop and test such designs before a physical prototype is constructed. This is possible because you can interact with the design using on screen indicators such as LED and LCD displays and actuators such as switches and buttons. Here instead of HT12E transmitter we were connected a LED to the corresponding pin. If the LED is ON, it indicates that the micro-controller is transmitting a signal.

## VI. CONCLUSIONS

In this paper, we proposed a Smart Energy Saving (SES) System that automatically blocks standby power. Additionally, we also proposed a method that simultaneously minimizes user's inconveniences and standby power, based on the user's behaviors. When the user is not present, the device becomes OFF from standby mode. We were able to implement all the functions specified in our proposal. The biggest hurdle we had to overcome with this project was interfacing the micro controller with the hardware components. A threshold value is to be set for determining standby power which was a little bit difficult. The range of PIR sensor was adjusted to get the required output. We feel that this standby power reducing system is useful because it is easy to use, comparatively inexpensive due to low power consumption, and highly reliable.

ISSN: 2394-4404

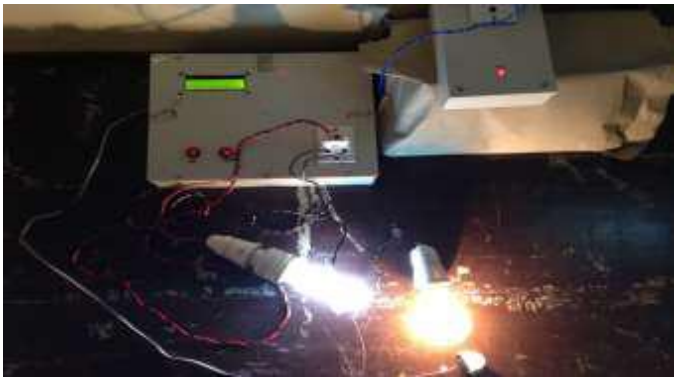

*Figure 4: Hardware Implementation*

The device is switched off from standby mode when there is no user interaction with the device for few minutes. This system simultaneously minimizes standby power and user's inconveniences. The proposed system reduces total power consumption up to 10.5%.

## REFERENCES

[1] Jinsung Byun, Sunghoi Park, Byeongkwan Kang, Insung Hong, and Sehyun Park, "Design and Implementation of an Intelligent Energy Saving System based on Standby Power Reduction for a Future Zero- Energy Home Environment", IEEE Transactions on consumer electronics ,vol 59,No 3,august 2013.

[2] Alphy John,I.Bildass Santhosam,"Home Energy Management System Based on zigbee", IJIES,vol:2,March 2014.

[3] C.-H. Tasi, Y.-W. Bai, C.-A. Chu, C.-Y. Chung, and M.-B. Lin, "Design and implementation of a socket with ultra-low standby power", IEEE Instrumentation and Measurement Technology Conference, pp. 1-6, 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] LCD16*2datasheet http://www.engineersgarage.com/electroniccomponents/16x2-lcd-module-datasheet.

[6] B. Todorovic, "Towards zero energy buildings: New and retrofitted existing buildings," in Proceedings of the IEEE 3rd International Symposium on Exploitation of Renewable Energy Sources, pp. 7-14, 2011.

[7] G. Song, F. Ding, W. Zhang, and A. Song, "A wireless power outlet system for smart homes," IEEE Trans. On Consumer Electron., vol. 54, no. 4, pp. 1688-1691, Nov. 2008.