Home Energy Management System Based On Zigbee

Alphy John, I.Bildass Santhosam

Abstract – To inculcate the Home Energy Management System (HEMS) based on ZigBee communication using remote controller and sensor. This technique brings out the more efficient home energy management system to reduce power consumption in home area. We consider the room easily controllable with an IR remote control of a home appliance. The room has power outlets, a light, sensor and a ZigBee hub. The ZigBee hub has an IR code learning function and educates the IR remote control signal of a home appliance connected to the power outlet. Then it can control the power outlets and the light in the room. The PIR sensor which detects the presence of the human and then it allows the power on the light.. A LCD is used in the hardware module for the user interface. The LCD displays the power consumed and the value of PIR sensor. The ZigBee hubs in each room communicate with the home server and report the power consumption information to the home server. The proposed architecture gives more efficient energy-saving HEMS.

Keywords - ZigBee, Remote control, IR, Energy–saving, Power Outlet, Standby Power,sensor.

I. INTRODUCTION

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. Network architecture for home energy management system (HEMS) based on power line communication (PLC) was proposed [1]. It is composed of one controller for monitoring and managing home energy and one network adapter for each home appliance. Another PLC -based HEMS combining a home network and the Internet was proposed [2]. The smart meter provides reports on power consumption through an energy service portal via a residential gateway. Home energy information is available online through a Web. Architecture of home energy saving system based on energy -awareness was proposed for real- time home energy monitoring service and reducing standby power of home appliances [3]. The embedded remote monitoring and controlling power socket was developed for automatic and power management of home appliances [4]. The power socket allows a user to remotely monitor and control home appliances through an Internet. The previous works provide a user with home energy consumption information and also enable remote monitoring and controlling for power management of home appliances.

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However, the previous systems do not allow a user to get a chance to actively reduce power consumption of home appliances. In this paper, we propose more efficient HEMS based on ZigBee communication and infrared remote controls. To implement the proposed system, an automatic standby power cut-off outlet with power measurement function, a ZigBee network hub with an IR receiver and a home server have been used. And also using one PIR sensor to detect the human presence for reducing the unwanted usage of the power.

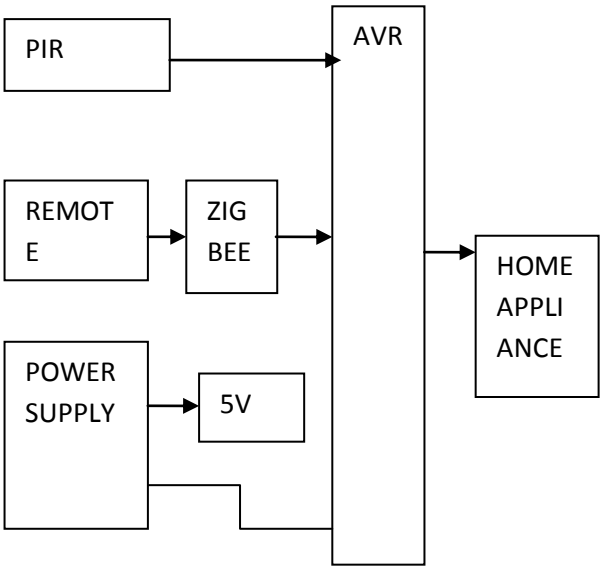

FIG 1:Block Diagram For Hems

II. EXPLANATION OF ELEMENTS

A. Power Supply for AVR 32 Micro controller:

This section describes how to generate +5V DC power supply

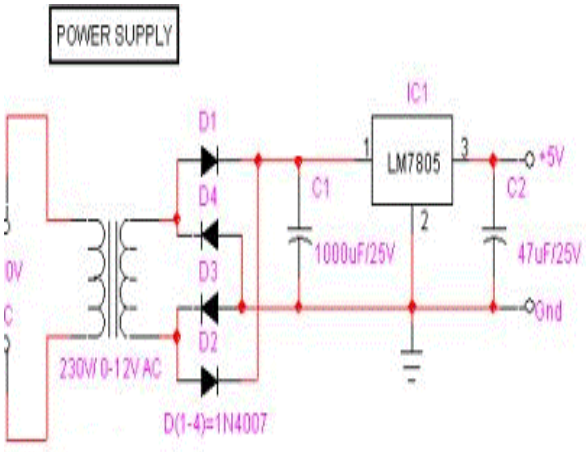

FIG 2: Power Supply

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The power supply section is the important one. It should deliver constant output regulated power supply for successful working of the project. A 0-12V/1 mA transformer is used for this purpose. The primary of this transformer is connected in to main supply through on/off switch& fuse for protecting from overload and short circuit protection. The secondary is connected to the diodes to convert 12V AC to 12V DC voltage. This is filtered by the capacitors, which are further regulated to +5v, by using IC 7805.

B. Serial Communication:

UART (Universal Asynchronous Receiver Transmitter) or USART (Universal Synchronous Asynchronous Receiver Transmitter) are one of the basic interfaces which you will find in almost all the controllers available in the market till date.

This interface provides a cost effective simple and reliable communication between one controller to another controller or between a controller and PC.

C. RS-232Basics:

RS-232 (Recommended Standard 232) is a standard for serial binary data signals connecting between a DTE (Data terminal equipment) and a DCE (Data Circuit terminating Equipment). TheRS-232 standard defines the voltage levels that correspond to logical one and logical zero levels. Valid signals are plus or minus 3 to 25 volts. The range near zero volts is not a valid RS-232 level; logic one is defined as a negative voltage, the signal condition is called marking, and has the functional significance of OFF. Logic zero is positive, the signal condition is spacing, and has the function ON. So a Logic Zero represented as +3V to +25V and Logic One represented as -3V to - 25V.Usually all the digital ICs works on TTL or CMOS voltage levels which cannot be used to communicate over RS-232 protocol. So a voltage or level converter is needed which can convert TTL to RS232 and RS232 to TTL voltage .The most commonly used RS-232 level converter is MAX232. This IC includes charge pump which can generate RS232 voltage levels (-10V and +10V) from 5V power supply. It also includes two receivers and two transmitters and is capable of full duplex UART/USART communication.

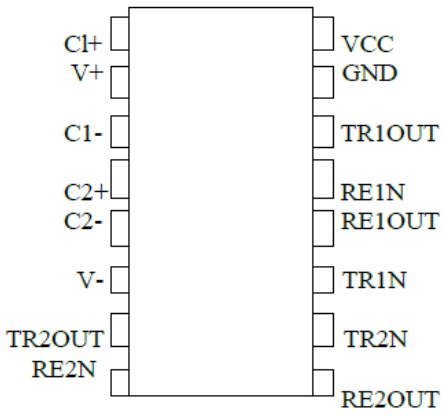

Fig 3 - Max232 Pin Description

D. ZigBee:

ZigBee is a specification for a suite of high level communication protocol used to create personal area networks built from small, low power digital radios. Zigbee is based on an IEEE 802.15 standard. Though low powered, ZigBee devices can transmit data over long distances by passing data through low – powered, ZigBee devices can transmit data over long distances through intermediate devices to reach more distant ones, creating a mesh network; i.e., a network with no centralized control or high power transmitter/receiver able to reach all of the networked devices. The decentralized nature of such wireless ad hoc networks makes them suitable for such applications where a central node can't be relied upon. ZigBee is used in applications that require only a low data rate, long battery life and secured networking, ZigBee networks are secured by 128 bit symmetric encryption keys. In home automation applications, transmission distances range from 10 to 100 meters line- of-sight depending on power output and environmental characteristics.

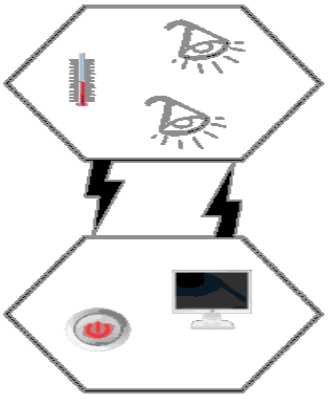

FIG 4: Zigbee High – Level Communication Model

FIG 5: A Zigbee Module

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.

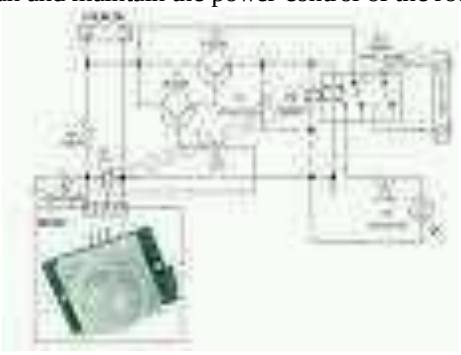

FIG 6: PIR Sensor

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F. Liquid Crystal Display (LCD):

In this project the LCD used is HD44780 Character LCD .When the meter is working the LED glows. The LCD continuously displays the consumed power and the PIR sensor reading.. Every peak time the information regarding units is sent to the home server..So the main purpose of LCD is to displays the information. TO display any character on LCD microcontroller has to send its ASCII value to the data bus of the LCD display used here is having 16*2 size. It means @ lines each with 16 characters.

F. Remote Controller:

Here in this project we are using one IR remote. The ZigBee hub has an IR code learning function and educates the IR remote control signal of a home appliance connected to the power outlet**.**

FIG 7: Remote Controller

III. CONCLUSION

We proposed the HEMS based on ZigBee communication and infrared remote controls. The ZigBee hub with IR code learning function enables a user to control the power outlet and the light, to reduce the remnant standby power, and to manage the home server for user- friendly information display. The proposed architecture provides more power reduction and user controllability than a general HEMS.

III. Internal structure Schematic

Diagram

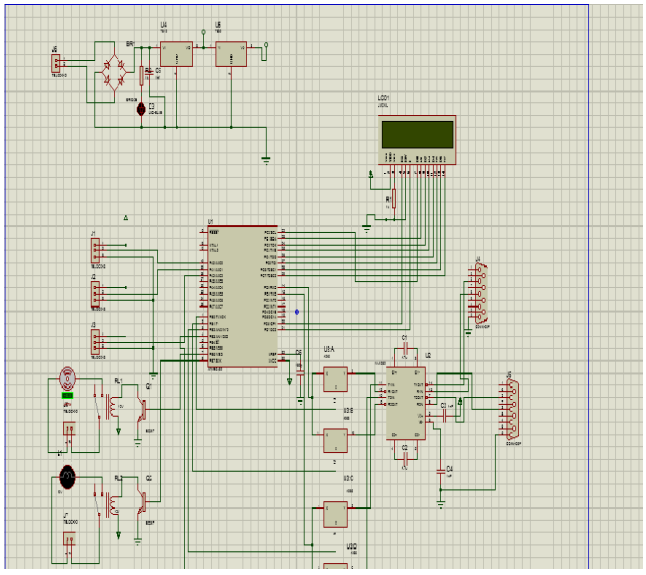
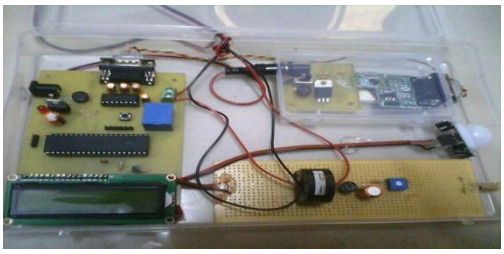


FIG8: Internal Structure Schematic Diagram

IV. PICTURE VIEW OF KIT



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