

Home Energy Management System with Security Using Zigbee Communication

Bhure ashatai Babarao^{*1}, Sonawane Neelam Ramesh²
¹(E&TC Dept. G.S. Moze college, Savitribai Phule Pune University, Pune),
²(E&TC Dept. G.S. Moze college, Savitribai Phule Pune University, Pune)

Abstract—Energy saving is very essential today. The energy resources reduce day by day and need of electrical energy increases every day. In India maximum electricity is generated by coal and coal mines becomes empty day by day. So there is great need to save electrical energy because power reduction is global issue. Government tried his best to save electrical energy but we also start from ourselves. For this here describes a system known as HEMS. It will reduce power consumption by managing home energy. For this consider a room which is automated using standby power cut-off outlet different home appliances communicate through zigbee communication to turn on or off the home appliance. Proposed architecture gives power saving and energy management; also provide a security to the home by using different sensors & GSM.

Keywords— HEMS, GSM, zigbee, PIC, standby, power consumption, power outlet.

I. INTRODUCTION

In India use of electricity is more than generated & maximum electricity is wasted because we forget to switch off the different appliances. Hence there is wastage of electric power. So electricity saving is started from our step of home. Many automatic systems were developed to save electricity, but they do not show hourly or daily or weekly utilization of power. So by using HEMS system we can save nearly about 5-10% of energy in each month [1],[2]. Home appliances consume a lot of energy. To reduce power consumption from home appliances is challenging job for us. Home energy management system save energy and also create awareness for saving electricity for real time home energy monitoring scheme [3]. It also saves home energy when appliances are in standby mode. The monitoring and controlling power outlets which are specially developed for power consumption and home energy management. There is display for displaying how much power will be utilized by the appliances daily, weekly, or monthly depending on consumers need. Home energy management system will also provide security for home by using some sensors. This paper presents HEMS with security and also shows energy utilization of the home appliances.

II. HEMS RELATED WORK

In the HEMS, all home appliances are connected to power outlet, to switch off device automatically when they are in standby mode. Design consists of two sections, one is transmitter section and other is receiver section. Transmitter section used as a remote control to completely turn on and turn off the power outlets and particular devices through keypad. Receiver section consist of different sensors for monitoring physical parameter which are used in power saving. A main sole of architecture is power outlet which is a part of receiver section.

A. Transmitter Section

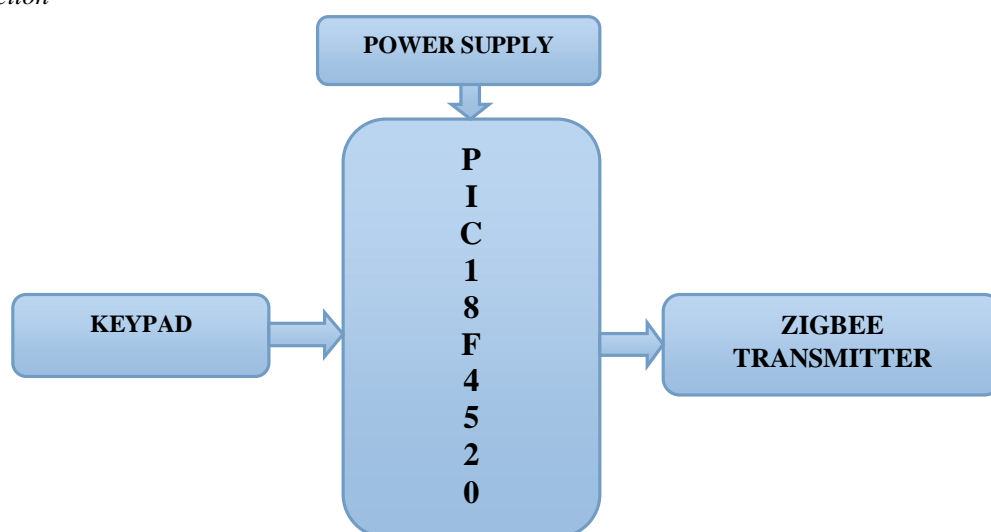


FIG. 1 TRANSMITTER SECTION

The transmitter section used as a remote control to turn on and turn off the the home appliances by using keypad. We can send information related to which device can operate to power outlet at receiver side by through zigbee communication. Zigbee is used due to its large range upto 100 ft to 200ft.

B. Receiver Section

Receiver mainly consist of power monitoring circuit, which is sole of architecture. Fig 2shows receiver section which consist of power monitoring circuit, PIC microcontroller interfaced with different sensors like temperature sensor , PIR sensor, LDR i. e. Light dependent register, vibration sensor for measuring different physical parameter for power saving and security purpose of a room where proposed architecture is implemented. Power monitoring circuit continuously monitors whether home appliances are in standby mode or not by checking its threshold value. PIC microcontroller is used due to its more internal flash memory and inbuilt compatibility with some interfaces. Vibration sensor and GSM module is a part of security of a room from thieves.

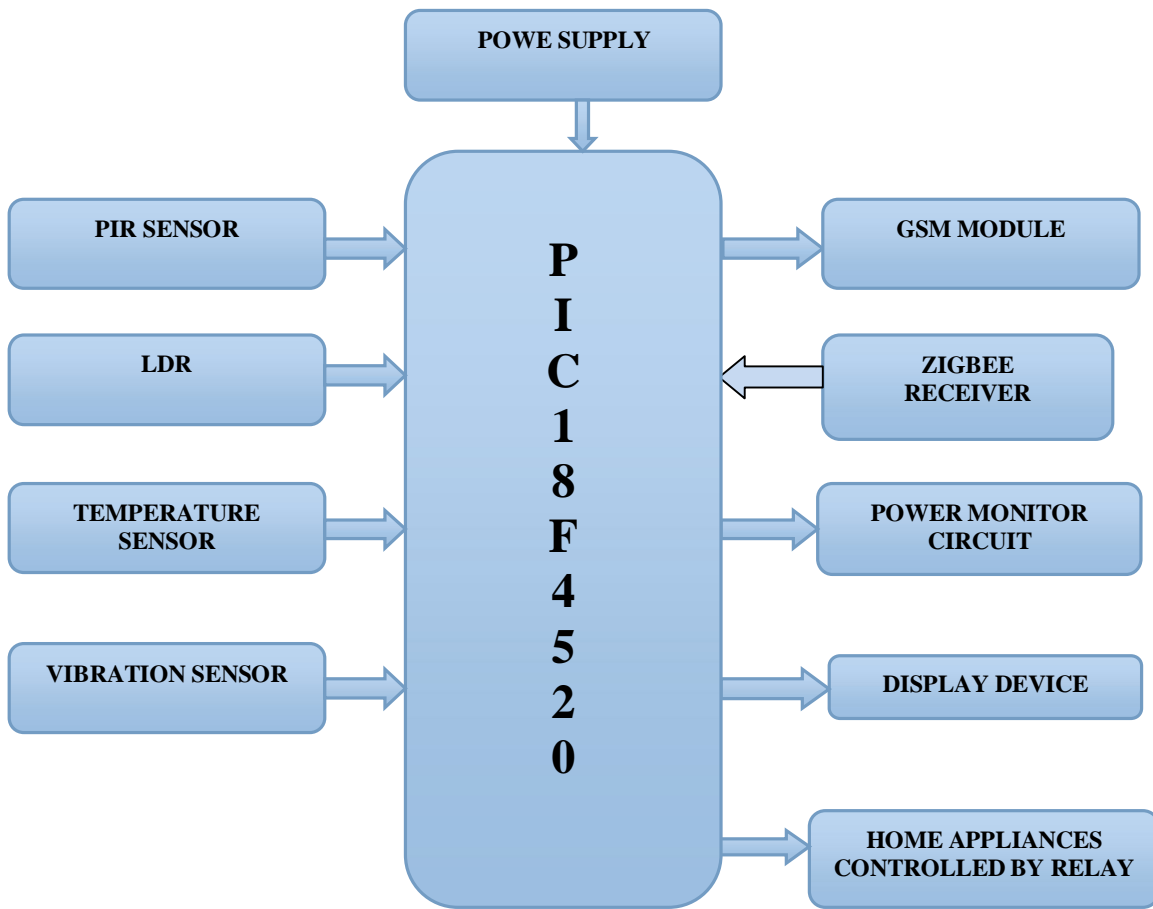


FIG. 2 RECEIVER SECTION

Above fig. Shows the receiver section in which different sensors are interfaced with PIC microcontroller and power monitoring circuit and different home appliances are connected also connected through relay. A display device is used to display how much power is utilized hourly, daily, or weekly basis by different home appliances. GSM module is used to send message to home owner if security related issue is there. Zigbee receiver is used to receive signals from transmitter for turning on or off the device.

III. AUTOMATIC STANDBY POWER CUT-OFF OUTLET

A. Standby power cut-off circuit

This circuit measures power consumption and convert it into voltage. The power outlet circuit is as shown below. It mainly consist of AC/DC circuit and monitoring circuit which is connected through relay.

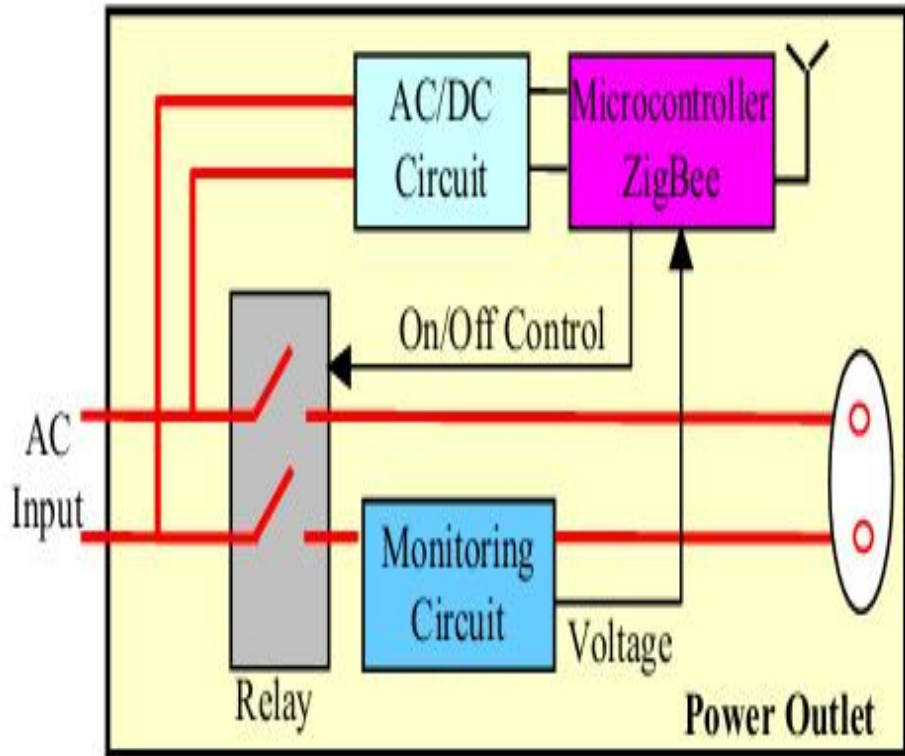


FIG 3 POWER OUTLET CIRCUIT

When it receives the turn-on Command, from transmitter, it turns on the relay to supply the AC power to the output port. This method can reduce even the standby power of the home appliance because the power outlet completely cuts-off the power supply. Although some power is consumed in the micro-controller and the AC/DC circuit, it is very small compared to the standby power of the home appliance. This proposed automatic standby power cut-off outlet can cut- off standby power without the central units.

The automatic standby power cut-off outlet is composed of an AC/DC conversion, one two port relay, a power monitoring circuit and a Microcontroller. The AC input is connected to the two port relay, output port of the threat by using various sensors to enhance security and to save power. In this system , ZigBee as wired or wireless networks are used to transfer the control information and the measured power[5].

B. State Transition diagram

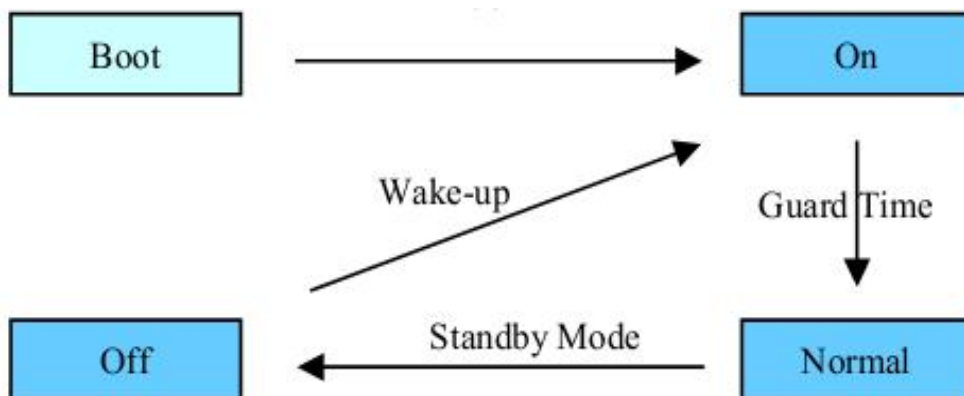


FIG. 4 STATE TRANSITION DIAGRAM OF ELECTRICAL OUTLET

The power outlet has four kinds of state: boot, on, normal, and off. After booting, the power outlet goes to the on state. After the guard time elapses, the normal mode starts and the microcontroller monitors the consumed power. When the measured power is below the threshold value for the predetermined time, the microcontroller decides the connected

home device is in the standby power mode and turns off the relay to cut off the power supply to the connected home device and it goes to the off state. When it receives a wake-up command from the ZigBee controller, it goes to the on state. This state transition repeats continuously. It is shown in fig. No 4.

IV. ENERGY SAVING ROOM ARCHITECTURE

A Sensor part

Here, we are using five types of sensors namely PIR sensor, LDR sensor, vibration sensor, temperature sensor are used to save energy and Security can be achieved by using vibration sensor. LCD is used to represent for what reason the home appliance is tripped OFF. And also show energy utilization of the room..The PIR sensor switch can detect the Infrared Rays released by human body. The light or any other electrical appliance can be activated automatically by the active presence of a human body with in the detection range coverage area & when there is no presence the light will be deactivated automatically. The PIR Sensor senses the motion of a human body by the change in surrounding ambient temperature when a human body passes across the sensor. Then it turns on the lighting load to which it is connected. The lighting load will remain ON until it senses motion. Once the motion is seized it switches OFF the lighting load [4].

Vibration sensor is used to protect door or window. It generates aloud beep when somebody tries to break the door or window. The circuit uses a piezo element as the vibration sensor. A piezoelectric sensor is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal [4]. As a result when any theft happens in home, due to the vibration or stress that was made over the door by thief electrical signal will be passed to the PIC18f4520A and further the output is given to our mobile through GSM.

V. CONCLUSIONS

This paper proposed a system which includes energy saving room architecture with security. With the help of this architecture a user can control various home appliances and save total energy consumption with the help of automatic power cut-off outlet circuit. User can also figure out how much utilization of power is done and displayed hourly or daily or weekly energy utilization of home appliances on LCD. To configure this room architecture we proposed an automatic power cut-off outlet circuit. For communicating between transmitter and receiver section we use zigbee module to cover maximum area. Finally using this system we can achieve our economical goal and also maintain security to our home.

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