

Wireless Sensor Network based power management system in building

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Abstract –The design and development of smart monitoring and controlling system for household electrical appliances in real time has been mentioned in this paper. The system principally monitors electrical appliances such as Fan, Bulb, Motor, Refrigerator, Television etc. The novelty of this system is the implementation of controlling mechanism of appliances in different ways. The developed system is low cost and flexible in operation and thus can save electricity expense of consumers.

Key Words: Power management, home automation, building control system, wireless sensor network, Zig-bee.

1. INTRODUCTION:

It is foreseen that service and personal care wireless mechatronics system will become more and more immanent at home in the near future and will be very useful in assistive healthcare particularly for the elderly and disable people. Wireless sensor networks (WSNs) have become increasingly important because of their ability to monitor and manage situational information for various intelligent power management services. Due to those advantages, WSNs has been applied in many fields, such as the military, industry, environmental monitoring and healthcare.

The WSNs are increasingly being used in the home for energy controlling services. Regular household appliances are monitored and controlled by WSNs. New technologies include cutting edge advancement in information technology, sensors, metering, transmission, distribution and electricity storage technology, as well as providing new information and flexibility to both consumers and providers of electricity.

2. MICRO-CONTROLLER (89s52):

The Atmel AT89 series is an Intel 8051-compatible family of 8-bit microcontrollers manufactures by the Atmel Corporation.

Based on the Intel 8051 core, the AT89 series remains very popularly as general purpose microcontrollers, due to their industry standard instruction set, and low unit cost.

This allows the great amount of legacy code to be reused without modification in the new applications. While considerably less powerful than newer AT90 series of AVR RISC microcontrollers, new product development has continued with the AT89 series for aforementioned advantages.

Features:

- Compatible with MCS-51 products
- 8K Bytes of In-System programmable (ISP) Flash Memory-Endurance: 10000 Write / Erase Cycles
- 4.0 volt to 5.5 volt Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 256*8 bit Internal RAM
- 32 Programmable I/O lines
- Three 16 bit Timer/Counters

3. COMPONENTS AND COMPATIBILITY:

The basic components used in our system are as follows:

1) Zig-bee (S2C):

Day by day, wireless system demand is increasing in homes due to easy placements and its coast and also you can connect easily by phone or computer. The home automation project is used control the home appliances includes fan, air conditioner and refrigerator, etc. by sending commands through the serial communication from the computer. This project is also very useful to control the electrical appliances in the room.

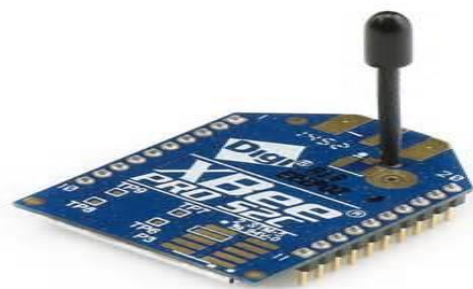


Fig.1 Zig-bee (S2C)

Features:

- Supports binding and multicasting for home automation.
- Mesh-network topology
- 2.4 GHz for worldwide deployment
- Common Zig-bee footprint fits Parallax zig-bee adaptors and the propeller activity board
- Industry leading sleep current of sub 1 micro Ampere

2) Load-unit:

The wireless Sensor Network comprises of zig-bee receiver module, microcontroller, relay driver. The load is embedded in the normal switch boards and hence minimum level of maintenance required for the system

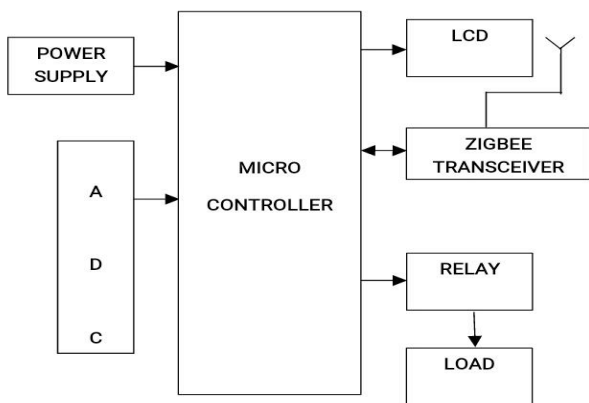


Fig.2 Load unit

3) Relay circuit:

It is monolithic high voltage and high current transistor array. The microcontroller drives the relays through the relay driver as per the algorithm. The reset of the component in the load unit acts similar to the once in the sensing unit.

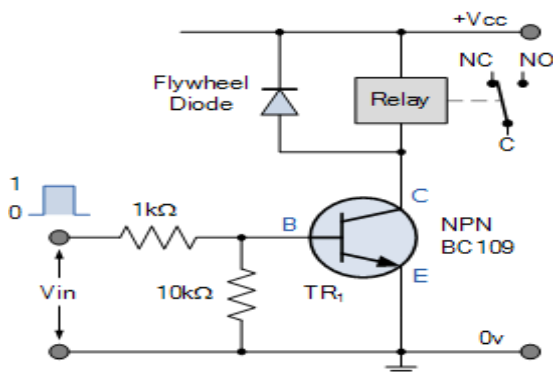


Fig.3 relay circuit

Note that the relay coil is not only an electromagnet but it is also an inductor. When power is applied to the coil due to the switching action of the transistor, a maximum current will flow as a result of the DC resistance of the coil as defined by Ohms Law, ($I = V/R$). Some of this electrical energy is stored within the relay coil's magnetic field.

When the transistor switches "OFF", the current flowing through the relay coil decreases and the magnetic field collapses. However the stored energy within the magnetic field has to go somewhere and a reverse voltage is developed across the coil as it tries to maintain the current in the relay coil. This action produces a high voltage spike across the relays coil that can damage the switching NPN transistor if allowed to build up.

4) LCD display[x1];

A liquid crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light modulating properties of liquid crystal. LCD are available to display arbitrary images or fixed images with low information content, which can be displayed. The LCD panel is made by glass. Any mechanical shock will damage the LCD module. It is easy to interface with micro-controller because of an embedded controller.

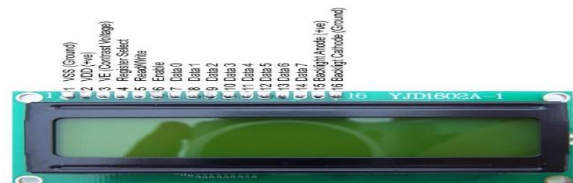


Fig.4 LCD 16*2 Display

4. HARDWARE CONNECTION -

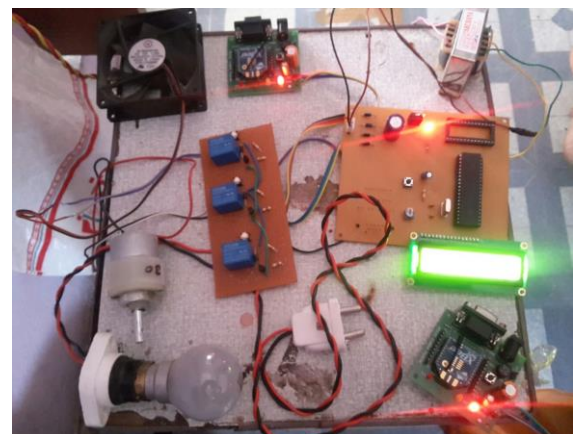


Fig- 5: Hardware connection

This project is used to control the home appliances using your Zig-bee and PC. All home appliances are connected with the microcontroller. When the command is sent over Mat-lab software. This project includes two main parts, such as transmitter and receiver. The transmitter section comprises of Zig-bee transmitter & RS232 circuit and receiver comprises of Zig-bee receiver & AT89s52 which is connected to relay and different home appliances like fan, motor, bulb, etc. When the command is sent through the PC Mat-lab. The command is transmitted through Zig-bee transmitter, then the Zig-bee receiver receives the command. After receiving this command it decodes and sends to the AT89s52 microcontroller. The micro-controller responds according to the command.

For instance, if we click on button "ON"(fan) of GUI, PC send command ON (fan) to microcontroller, then the fan will ON and if we click on button "OFF"(fan), PC send command OFF(fan) to the microcontroller, then the fan will OFF. All the AC devices are connected through relays when the microcontroller transmit command ON to relay the matching device is ON and when transmit command OFF to relay then the device is OFF.

5. CONCLUSION -

The smart power monitoring and control system has been designed and developed toward the implementation of an intelligent building. The developed system effectively monitors and controls the electrical appliance usages at an elderly home. Thus, the real time monitoring of the electrical appliances can be viewed on PC (GUI). The system can be extended for the monitoring whole intelligent building. We aim to determine the areas of daily peak hours of electricity usage levels and come with solutions by which we can lower the consumption and enhance better utilization of already limited resources during peak hours. This study also aims to access consumer's response towards perceptions of smart grid technologies, their advantages and disadvantages, possible concerns and overall perceived utility.

6. FUTURE SCOPE

Application for windows, android and ios platform can be design enabling the control of the load unit via laptop, computers, tablets and mobile phones. Voltage / current regulation can be implemented in order to vary the intensity/speed of different loads, thereby making a system more energy efficient.

APPLICATION

Power management in:

- Hotels
- Apartments
- Hospital
- Industries

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