Home load simulation using wireless ZIGBEE

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Abstract-**This paper defines the monitoring of power and controlling relay using wireless ZigBee. These papers propose a system design for wirelessly controlling relays and monitoring current which is used for home simulation. The wirelessly turning relays gets on and off by sending commands from a PC to the microcontroller by which the total load current tour simulated homes can be changed. In this paper, for wireless communication XBee series to ZigBee RF modules used. One of the modules is connected to a microcontroller and the home load simulation while another is connected to PC which is used for collecting and displaying data as well as relay monitoring and control.**

Index Term- **ZigBee, wireless sensor network, electrical safety, Home simulation**

I.   INTRODUCTION

As the population is increasing day by day in our world so the rate of power required is also increasing. More power requirement is the result of grown modern technologies in the cities as well as in the villages. Hence a development of wireless home automation system becomes a part of the life.[1] Home automation system has grown over the years as a need to control the power consumption. Wireless home automation system is needed for a system that can respond to commands like on /off status of electrical device using pc or cellular phones[2]

In this paper, ZigBee for the wireless communication between the controller and devices is used,. ZigBee is a high level communication protocol area with low power digital radio which is based on IEEE 802.15 standards[2].

Many appliances and items in the home are simulated with the use of registers. This system provides the user wirelessly controlled appliances by switching it on and off. Hence power consumption is managed by this system[4]. It provides user graphic information of the data in the computer in real time power used at home. The simulated home will be consisted of the seven appliances designed by resistance or load. 5V, DC power is supplied to all the simulated home devices by microcontroller. Generally home is supplied to 120 voltage AC current but the simulator home is independent from this need.

This design is based on the network layer and the software are Xbee chips and firm ware for the data links and the Xbee-API and the Xbee-Aurino software eases works for the network layer. The ZigBee is used due to low power consumption for the microcontroller unit end of the transmission. It is less complicated and easy to implement[5].

II.   WHY ZIGBEE?

Zigbee is a high level communication protocol that creates personal area network with low power digital radios. Which is based on IEEE 802.15 standard[2]. ZIgbee provides low power consumption that limits the transmission distances. It can provide long distance communication using the mesh network. It is basically used in low data rate applications and also used for higher battery life and secure networking. Zigbee has a rate of 250 kbps , that is enough for data transmission from a sensor[6]. Zigbee is also efficient, less expensive. Then other wide personal area network such as wifi or Bluetooth[5].

The most important factors that make ZigBee useful for wireless communications is descried as below [1][2][3]:

- For long battery devices
- Very low drain current
- It does not need much power
- Low data rates required
- Low cost
- Easy to implement

III.   **ZIGBEE AND BLUETOOTH**

ZIGBEE and Bluetooth are common to each other as both operates in the same frequency band of 2.4 GHz and belong to the same wireless private area network[9].

But there are many differences between them which can be explained as[8][9]:

- Bluetooth is geared toward user mobility and eliminating cabling between short distanced devices whereas ZIGBEE is more oriented remote control and automation.
- User with Bluetooth supported devices are able to effortlessly exchange the documents. While ZIGBEE supports protocol for defining a type of sensors network that controls applications used in residential areas.
- Typical joining a network using Bluetooth takes three seconds while for ZigBee it is 30 Milliseconds.
- Depending on radio class, Bluetooth has a network range of 1 to 100 meters while ZigBee is up to 70 meters with maximum network speed of 1 M bit per second to 250 M bit per second respectively

- .Batteries for bluetooth devices are rechargeable whereas for ZigBee are not rechargeable but longer lasting.

IV.   ZIGIBEE AND WIFI

- In the race between the wireless standards ZigBee and Wifi to network homes to enable smart energy management, ZigBee has so far taken the lead. But that doesn't mean that wifi is giving up its push into the smart energy home[10]. The two camps have made much of their comparative advantages in the field — but at the same time, both are working on making their technologies interoperable.

- Hence ZIGBEE and WIFI can be differentiated on the following basis[9][10]:

- Most smart meters that are being deployed have ZigBee radios to communicate with home energy devices. Wi-Fi's penetration has been limited to wireless thermostats and other devices — though the ubiquity of Wi-Fi in the home could push more energy-aware devices to support it.

- ZigBee was built with low-power sensors and controls in mind, and has much lower processing, memory and power requirements than Wi-Fi as a result. The Wi-Fi Alliance counters that its members are hard at work on lower-power chipsets that could compete with ZigBee's advantages there.

- ZigBee device makers have overcome early problems with smart meter-home device connectivity by boosting power from 10 milli watts volts to 100 milli watts volts, the maximum allowed for the unlicensed 2.4GHz spectrum in which it operates. ZigBee will have to compete against other technologies in that spectrum, including the latest iteration of Wi-Fi.

- The ZigBee Alliance says that its technology has built-in frequency agility and inter-packet spacing to allow it to work amidst interference. It's also a mesh networking technology, meaning that every in-home device can also help propagate the network around obstacles.

- Combinations that use Wi-Fi as a backbone and ZigBee as a link to multiple end-points are likely to see greater adoption as both teams work to integrate their technology.

V.   IMPLEMENTATION

In this for the system design, we are creating a wireless sensor network which will Communicate with number of modes using Full Duplex Mode. The communication will consist of data transfer that control mode operation. Wireless communication will be achieved by using zigbee protocol. As the nodes require very less amount of power , a zigbee protocol is used for the design. Power is used by each node that is consumed by the appliances.

Main purpose of the system is to create a wireless sensor network that will lead to the home load simulation. The major parts of the proposed design includes the control unit, end device unit having zigbee interfaces , pc and microcontroller.

VI.   HARDWARE

Different hardware used in power monitoring and controlling in home load simulation is described below:

- POWER CONTROL

It has three parts: power monitoring module using zigbee, home sensor and remote control section. Power monitoring module is based on solid state relay, a current monitoring circuit and a zigbee end devices. Home sensor module is comprised of zigbee coordinator and embedded based board. The remote control section is the personal computer. Sensor in zigbee based power monitoring module senses electronic current being used by electric outlet. Current measuring circuit measures the current and send to microcontroller unit. Microcontroller unit turns the electric outlet on and off. Solid state relay is used instead of traditional relay to minimize power consumption.

- DIRECT LOAD CONTROL BY USING POWER MONITORING

Real time power monitoring structures based on zigbee is made up of three modules:

1. Power management module
2. Remote monitoring control module
3. User module

Further power monitoring module is made up of two parts i.e. power observing side (POS) and power controlling side (PCS). POS monitors power consumption and PCS controls the power from the devices. POS can be remotely operated through any web browser in PC. RMCM enclose measure of software components of POS.ZC is linked to RMCM for sending and receiving messages to zigbee services on power management module.

Digital signal processing is a part of POS that is liable to calculate various power parameters and become aware of power omission in real time. The power is transmitted to sensor side through zigbee RFD that is an end device that collects data from different sensor and send to gateway.

The major components of RMCS are Authentication aand Authorization component verifies consumer identity and is used for security purpose. Warning message transmission is capable of sending message through emil and mobile phones.

- POWER MONITORING AAND CONTROLLING ARCHITECTURE

Power monitoring is based on data acquisition (DA).Data processing (DP) and application. Data acquisition is composed of wireless sensor used for measuring ac and power outlets. DP collects information from all the sensors through zigbee and make a data base of all the collected information and response to appeal from users.

- TRANSMISSION LINE MONITORING

This system is based on information collection unit (ICU) and information collection unit consists of sensors, DSP, ZIGBEE, RFD. Sensor keep information of power consumption in analog form and convert analog information into digital information and send to DSP unit.DSP unit calculates variation in power consumption and send the information to ZC through ZIGBEE RFD.ZC sends all the information coming from different sensors to data management center.

VII.   CONCLUSION

In this paper, ZigBee based power monitoring and protection system for home electrical safety is introduced which is cost effective. The proposed system could improve the traditional system and enhance the electrical safety. In addition extended functions such as power saving strategies can be easily implemented. ZigBee's wireless open standard technology is being selected around the world as the energy management and efficiency technology of choice. Implementing simulating meters with an open standard such as ZigBee helps to keep costs down, ensure interoperability, and future-proof investments made by both utilities and consumers.

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