An Intelligent Self-Adjusting Sensor for Smart Home Services based on ZigBee Communications

ABSTRACT

From many years all the appliances used in the homes are controlled manually and with the help of electrical switch systems. But this kind of controlling takes a lot of human effort as different devices are controlled from different points and you have to move to attend every single device. The idea now is to make all this system intelligent and fully automated and controlled by them. Intelligent information appliance is the main direction of development in the appliance control field. Intelligent appliance network has small amount of data and high speed of data transmission.

The Wireless Sensor Network (WSN) is built of nodes, from a few to several hundreds or even thousands, where each node is connected to one or sometimes several sensors. A wireless sensor network (WSN) consists of various distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. Thus, the Wireless Sensor Network is been proposed for the large range of applications in home, health monitoring and industrial automation. Especially the Zigbee standard that is getting more and more popular in the field of Wireless Sensor Network due to its low data rate and low power consumption.

In this project, based on Wireless Sensor Network we are using ZigBee technology, the ARM microprocessor and Embedded C to synchronize all the nodes and make a self-adjusting network of sensors for our smart home services. The self-adjusting sensors will be continuously monitoring the environment and updating the server side through the network. Based on the thresholds of the sensors the nodes will be generating a signal that will be transmitted to the server and also some action will be taken. This project is different from the general home automation as in home automation there is just a normal ON/OFF commands sent to the devices but in this project the sensors are smart sensors they are monitoring the condition accordingly and acting according to their set threshold. And there will be a USB interfaced camera that will be recording the event when no one is there in the rooms. Thus, this project is very helpful and very assistive for the people in the future.
INTRODUCTION

Various progressive wireless communication standards were developed and implemented. GSM, Wi-Fi and Bluetooth are well known by most people in the modern society. These standards have penetrated into their daily routine with outstanding popularity.

In here we are developing a Wireless Sensor Network that collects information from the surrounding sensors from a home. The information collected by the sensors is sent to the PC using Zigbee protocol. The PC further shares the data on to the server database recording the details. This server can realize real-time motoring and control for the remote object.

This project introduces the smart and intelligent sensors that monitors and controls various home appliances. The system is developed through ARM microprocessor, Embedded C and ZigBee wireless communication technology and network technology. It gives the overall framework of hardware and software design, and describes ways to implement the system.

User does not need to switch ON/OFF the home appliances, all the home appliances will be switched ON and OFF automatically. The smart sensors are implemented in a very efficient way that helps the user to be free from the worries of Switching ON/OFF their devices. They can leave their devices and move to their work, the devices will automatically switch ON/OFF the appliances that are useless or found to be running free.

This system provides mutual interoperability between various electronic, electrical, and power devices as well as interactive interface for people to control their operation. These features are very helpful to optimize and to economize energy consumption whereby saved energy during some few years could make more money than Home Automation systems implementation cost. These technologies make peoples’ life also easier, especially for elderly persons and persons with disabilities.
WORKING PRINCIPLE

Zigbee is one of the most widely used protocols for the wireless home automation. In this project we are displaying the efficient use of the microcontroller and the Zigbee protocol. The Wireless Sensor Network (WSN) is built of nodes, from a few to several hundreds or even thousands, where each node is connected to one or sometimes several sensors. A wireless sensor network (WSN) consists of various distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc.

Here in this project we are using a Zigbee & ARM Based Wireless Sensor Network to develop a network with smart sensors that automatically controls the devices without need of any commands from the user side. The ARM based microcontroller unit keeps eye on all the data collected by the sensors. As soon as the sensors detect something signal is generated and accordingly desired action can be performed. For example if the temperature inside the room high the fan will be ON and accordingly as the temperature goes down the fan speed will decrease with the temp falling and then stop after sometime. And there is a USB wired Web cam interfaced that can be used to check the real time view of the place. Thus, the user can check his place when at any time he wants.

HARDWARE REQUIREMENT

- MICROPROCESSOR: ARM7 (LPC2129)
- POWER SUPPLY: 5V-12V
- Zigbee Module
- SENSORS: TEMPERATURE SENSOR (LM35), PIR SENSOR, GAS SENSOR, LDR SENSOR.
- USB CAMERA
SOFTWARE REQUIREMENT

- Embedded C
- Proload
- Proteus
- KEIL IDE
- C# and .NET

ADVANTAGES

- Have a capacity to integrate a lot of sensors on a same wireless medium.
- Time saving, continuous and efficient monitoring system.
- More Reliable than that as compared to the wired Home Automation.
- Portable and can be changed as per our requirement unlike the Wired ones.

DISADVANTAGES

- Battery consumption is more due to simultaneous data transfer.
- The Installation charge is very high.

APPLICATIONS

- Home Control
- Personal Health Care
- Industrial control
- Building automation
- Consumer electronics
- PC & Peripherals
- Environment monitoring.
LITERATURE SURVEY

Recent advances in micro-electro-mechanical systems and wireless communication technologies have led to great progress in wireless sensor networks (WSNs). WSNs are wireless networks composed of numerous spatially distributed sensors with limited data gathering and processing capability to monitor the environmental situation. WSNs have become increasingly important because of their ability to monitor and manage situational information for various intelligent services.

Nowadays, WSNs are gradually being used in the home for energy management services. For example, lighting is automatically controlled through information such as the resident’s movement or the intensity of illumination gathered by WSN’s, and consumer devices are monitored and controlled by WSNs installed in the home.