Zigbee Based Wireless Home Security System

Kanishk Singh Chouhan[1], Rahul Moud[2]

[1]Electronics and Communication Engineering, Geetanjali Institute of Technical Studies, RTU , Kota, Udaipur, India
kanishkchouhan8[at]gmail.com

[2]Assistant Professor, Electronics and Communication Engineering, Geetanjali Institute of Technical Studies, RTU , Kota, Udaipur, India
rahul.moud[at]gits.ac.in

Abstract: *Now a days, Home Security threat is the most challenging task in our life. To overcome this threat, our houses must be Smart. This paper gives a solution to overcome the Home security threat. Using Zigbee network enabled digital technology, we can make our home Smart and secure. The technology gives us the opportunity to increase the connectivity of various devices hence we can get an overall security solution. Moreover, as the area of Internet is widening, we can remotely control and monitor the network enabled devices. The device can also send signal to the remote person whom we want to notify about the threat. Common gateway is used by both the Zigbee security system and Wi-Fi network for integration purpose. The use of this system would be user-friendly, flexible and cost effective. This system will based on Zigbee network. Hence, the hardware required would be Zigbee Modules, Micro-Controller (ATMEGA168), Relays, Voltage Regulator and various sensor devices. In this method, The sensors will sense the threat and send signals to the micro-controller through Zigbee network and the micro-controller would take appropriate action and send signal to the remote location on the reception of threat signals.*

Keywords: Zigbee, Microcontroller, Sensor Network

1. Introduction

ZigBee:
ZigBee is a wireless network protocol specifically designed for low data rate sensors and control networks, There are number of applications that can benefit from the ZigBee protocol: building automation networks, home security systems,industrial, controlnetworks, robotic applications remote metering and PC peripherals are some of the many possible applications. Compared to other wireless protocols, the ZigBee wireless protocol offers low complexity, reduced resource requirements and most importantly, a standard set of specifications.

Network:
The most basic explanation you can give for ZigBee technology is that it's a network for the exchange of low rates of data over low power devices in close proximity. This makes ZigBee appealing to small scale projects which need wireless communication. In a commercial sense, ZigBee standard networks are perfect for home automation like Smart lighting and temperature control, home entertainment, medical data collection, industrial control, Smart energy, embedded sensing, building safety sensing and many more applications where a low bandwidth is used and the battery life of devices needs to be preserved. The low power rate of devices means transmission of data is limited to between 10m-100m line-of-sight, but within a network of ZigBee devices the data can be spread much further.

Home Security System:
Zigbee technology was came to be known in 2004, since then it is benefice several networking systems. The mainfunction of the zigbee device is to create network by connecting the input sensors and Electro-Mechanical relays, Motors and Alarms as output

We have used Zigbee technology because it is reliable, low power consumption, low data rate, supports up to 65,000 nodes in a network, can automatically established its network and uses small packets compared with WiFi and Bluetooth. This system consist of two modules-
Entrance Sensing Module
Control Module with Relay Controlling Circuits.

Sensors and Actuators:
Zigbee technology was came to be known in 2004, since then it is benfits several networking systems. The main function of the zigbee device is to create network by connecting the input sensors and Electro-Mechanical relays, Motors and Alarms as output. An actuator is a part of a device or machine that helps it to achieve physical movements by converting energy, often electrical, air, or hydraulic, into mechanical force. Simply put, it is the component in any machine that enables movement.

Gateway:
In most IP-based networks, the only A gateway is network node used in telecommunications that connects two networks with different transmission protocols together. Gateways serve as an entry and exit point for a network as all data must pass through or communicate with the gateway prior to traffic that does not go through at least one gateway is traffic flowing among nodes on the same local area network (LAN) segment. The term default gateway or network gateway may also be used to describe the same concept.

IP Configuration:
Internet Protocol Configuration (ipconfig) is a Windows console application that has the ability to gather all data regarding current Transmission Control Protocol/Internet Protocol (TCP/IP) configuration values and then display this data on a screen. Ipconfig also refreshes the Domain Name System (DNS) and Dynamic Host Configuration Protocol (DHCP) settings each time it is invoked. When invoked

without additional parameters, ipconfig simply displays the IP address, default gateway and subnet mask for all available adapters.

WiFi:
Wi-Fi is a family of wireless network protocols, based on the IEEE 802.11 family of standards, which are commonly used for local area networking of devices and Internet access, allowing nearby digital devices to exchange data by radio waves.
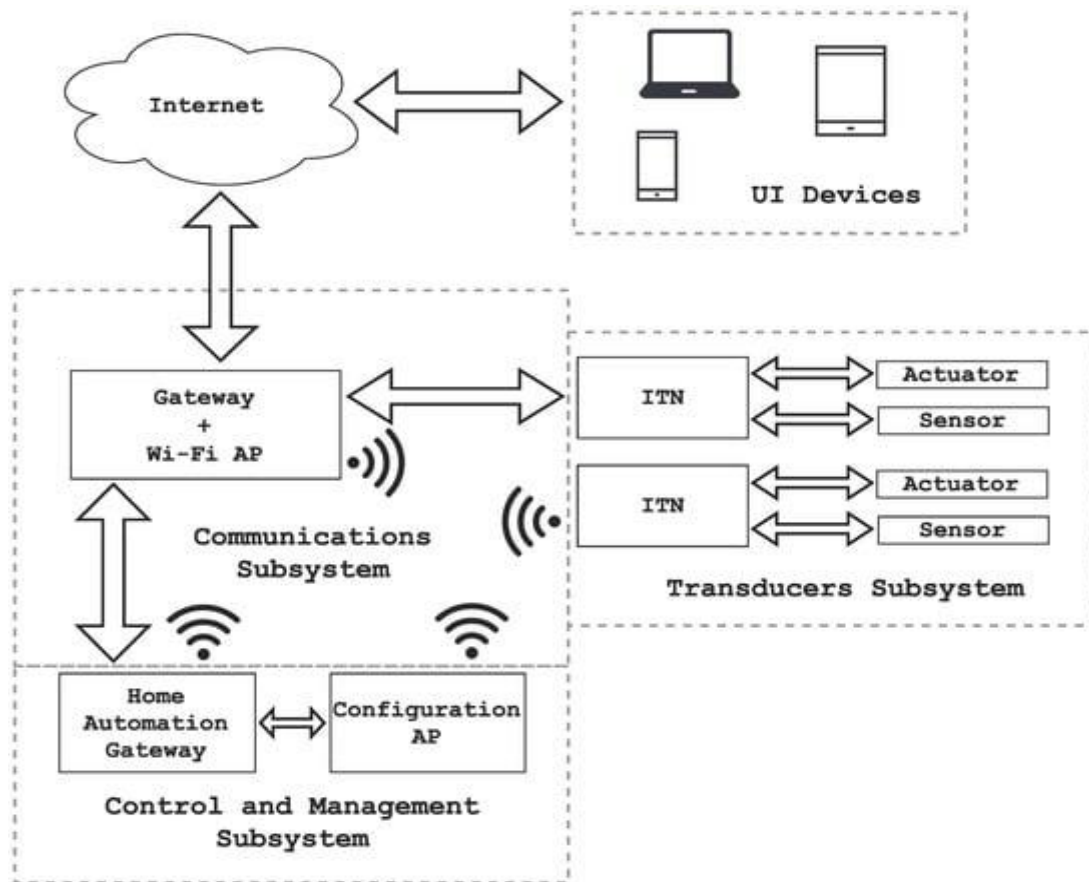
Ease of Use

User friendly
The system will be very user friendly ,updated with simple and understandable GUI (Graphicaluser interface) so that anyone can use it . Cost effective & Beneficial in both household and technical applications

This system can be used in Commercial purposes, Domestic uses, technical applications etc. Its not pricy or expensive and comes at a minimal rate.The simple electrical and electronics stores can even sell it. Can be installed anywhere and has no Installation cost.

It has many Benefits as it can be beneficial to old aged and kids.Alsoin nights old age people or kids can easily turn on lights by just tapping on screen.

The devices used are follow
1) **Micro-controller (ATMEGA168***):*ATMEGA168 is a member of AVR family. AVR is a family of micro-controllers developed by Atmel. THis is modified Harvard architecture 8-bit RISC single chip micro-controller. It is high-performance, Low-power Microchip RISCbased CMOS 8-bit micro-controller combines 16KB ISP flash memory with read-while-write capabilities,512B EEPROM, 1KB SRAM,23 general purpose I/O lines, 32 general purposeworking registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, byte-oriented 2-wire serial interface, SPI serial port, 6-channel/10-bit A/D converter,programmable watchdog timer with internal oscillator and five software selectable power saving modes. It has 32 pin count and have operating voltage range of 1.8V to 5.5V. This AVR microcontroller have internal EEPROM for semi permanent data storage. This EEPROM maintain data stored in it even after the removal of power. The data stored in this micro-controller retains for almost 100 years at 25°C, that means for a very long time. One of the important feature of this AVR micro-controller is that It has Flash, EEPROM and SRAM integrated on a single chip.

2) **Zigbee RF Communication:** Zigbee is global standard based on the IEEE 80.15.4 standard with low-power, low-cost, wireless mesh networking. Zigbee represents a network layer above the 802.15.4 layers to support advanced mesh routing capabilities.

Zigbee branching are of 3 types

- **Coordinator**: A branch that has the unique function of form a network. The coordinator is responsible for established the operating channel and MAC ID for an entire network.
- **Router**: A node that creates/maintains network information and uses this information to determine the best route for data packet. A router must join a network before it allows other routers and end devices to join.
- End devices must always interact with their parent to received or transmit data. They are intended to sleep periodand therefore have no routing capacity. An end device can be source or destination for data packets but cannot route packets.

The Zigbee standard supports three security modes:

- **Residential security**- It requires a network key be shared among devices.
- **Standard security**- It adds a number of optional security enhancements over residential security including an APS layer link key.
- **High security-** It adds entity authentication and a number of other features not widely supported.

Characteristics of Zigbee Technology-
Reliable and self healing
Supports large number of nodes
Easy to deploy
The speed of data rate is 250 Kbps.
Very long battery life
Secure
Low cost
Supports multiple network topologies e.g. Point to point, point to multi point, mesh network and cluster tree.

Differentiate of Zigbee with related technologies:

Technology	Bluetooth	Wifi	Zigbee
Frequency	2.4GHz	2.4GHZ 5GHz	868MHz 915GHz 2.4GHz
Modulation	FHSS	QPSK COFDM QAM	BPSK O-QPSK
Error Control	CRC(16 bit)	CRC(32 bit)	CRC(16 bit)
Range	10m	100m	10m-100m
Network Size	8	2007	64000
Power Consumption	Medium	High	Very Low

References

[1] ZigBee Alliance, http://www.caba.org/standard/zigbee.html.
[2] LAN-MAN Standards Committee of the IEEE Computer Society, Wireless LAN medium access control (MAC) and physical layer (PHY) specification, IEEE, New York, NY, USA, IEEE Std 802.11-1997 edition, 1997.
[3] LAN-MAN Standards Committee of the IEEE Computer Society, Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal AreaNetworks (LR-WPANs), IEEE, 2003