Wireless Communication Using Zigbee Module and Aurdino

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ABSTRACT: *Zigbee wireless communication technology is a kind of newly arisen wireless network technology; the characteristic is short distance communication, low speed, low power dissipation, and low cost. It, application of Zigbee wireless communication technology, makes that inconvenient wire repeat can be avoided in the area of home, factory, hospital, etc. With the rapid development of IT industry and the strong functional expansion of SCM, Zigbee wireless communication technology will play an important role in wireless sensor network (WSN). In this paper, Zigbee wireless communication technology and the process of establishing Zigbee network are introduced, the application of Zigbee wireless communication technology is studied in the real world*

I.   Introduction

Most communication sensor networks are built based on GSM in currently used communication system, in which signals and data are transferred through cable. Compared to traditional distributed cable network, GSM INTERNET network have greatly improved in expansibility and difficulty of construction and maintenance. But there are still some defects. The cables are easily to be eroded, bitten by rats, frayed, causing to high fault rate and high false communication rate. The cable transmission distance is limited, usually no more than 1km, otherwise the attenuation and interference will lead to failure of system.

We may conceive that, constructing communication system in wireless transmission way, can avoid above problems. A new way of wireless signal relay also can increase communication signal transmission distance. With microelectronics and wireless communication technology development in recent years, this can become a reality. This paper introduces a method of constructing Wireless communication system based on ZigBee technology.

II. Zigbee Technology

ZigBee is an alternative name of IEEE 802.15.4, a wireless network protocol released in 2005. ZigBee technology is a two-way radio communication technology, mainly suitable for communication between two points based on wireless communication.

It can be embedded in various consuming electronics, family and building automation equipment, industrial control equipment, various sensors equipment, also supporting the geographical location function. ZigBee has the following features:

☐ Low power dissipation. Due to short working cycle, it has low power dissipation in sending and receiving messages, and adopts a sleep mode. Two 5# dry batteries can support a node work for 6 to 24 months, or even longer.
☐ Low cost. Dramatically simplifying the protocol and reducing the requirement of communication controller, causes very low cost. The modules are cheap, and ZigBee protocol patent is free.
☐ Low transmission rate. It works at 250kbps rate, satisfying the application requirements of low data transmission rate.
☐ Short distance. The transmission distance between adjacent nodes is usually 10 ~ 100m. If increase transmitting power of RF, the distance can be 1-3km. If through the routing and communication relay, the distance will be even more.
☐ Free frequency band. It uses direct sequence spread spectrum technology, working at global free ISM 2.4GHz frequency band.

☐ Short time delay. ZigBee has optimization in time delay sensitive application, the communication delay and activated delay from dormancy is very short. Generally, from sleeping to working, just needs 15ms, and the nodes connecting to network needs only 30ms.

☐ High capacity. ZigBee network can be constructed in different types. A master node can manage 254 nodes, still can extend to bigger network by each node. Total network can have 65535 nodes in theory.

☐ High security. ZigBee provides a three-level safe mode, including data integrity checking and authenticating, using Access Control List (ACL) to prevent illegal data acquisition, using Advanced Encryption Standard (AES128) symmetrical passwords to determine the security attribute flexibly.

☐ the equipment cost low, transmitting data volume is small

☐ equipment is small in size, unfit to place big battery or power module

☐ unfit to replace batteries frequently or inconvenience for charging repeatedly

☐ cover a wide range of communication, many equipment in network , but only for monitoring and controlling Automatic fire alarm system has almost all of the above characteristics, so it's very suitable to be built based on ZigBee technology.

III. Arduino Technology

The Arduino micro-controller is the main component that is centrally connected to all the components. The sensors are connected to the analog input of the Arduino micro-controller. The Arduino is also connected to the 16x2 LCD and the PC. These are the outputs from the Arduino. The LCD is connected to the digital pins D5- D2 and RS and E pin are connected to 12 and 11 pin respectively. And the back-light control is connected to digital pin 13. The rest other pins are connected to the GND..

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version1.0 will be the reference versions of Arduno moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions see the index of Arduino boards.

IV. System Designing

4.1 System Structure:
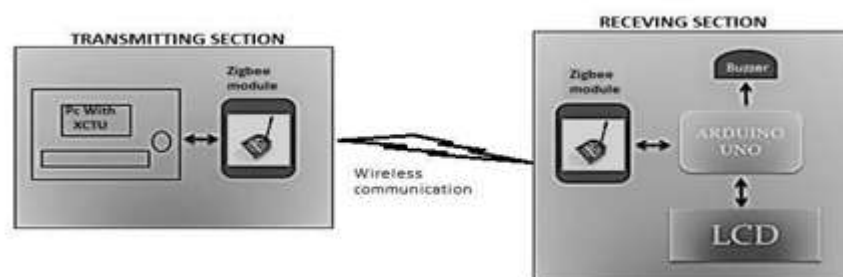
The system uses ZigBee wireless network to achieve communication, mainly includes three parts: the data Zigbee modules, XCTU software, Arduino, [3] as shown in Fig. 1. The Zigbee devices communicate with each other wirelessly over the air. They can simply transfer the information what they receive. But they can be interfaced with other microcontrollers and processors like Arduino, Raspberry Pi or PC via serial Interface. So, basically, Zigbee modules are capable of two types of communication - wireless communication and serial communication. The wireless communication takes place between Zigbee devices so that the devices act as radio frequency (RF) devices. For data to transmit and receive from one Zigbee module to another, both devices should be on same network. The data between two devices is transmitted wirelessly. By serial communication (UART), the Zigbee modules can communicate with microcontrollers and processors.

A microcontroller, processor or PC can send data through the serial interface to the Zigbee module (transmitter) and the Zigbee module wirelessly transmits the data to other Zigbee module (Receiver). The receiver Zigbee module transmits the data through the serial interface to controller, processor or PC to which it is interfaced. The controller interfaced to the Zigbee module processes the information received by the Zigbee devices. This way, controllers can monitor and control remote devices by sending messages through the local Zigbee modules.
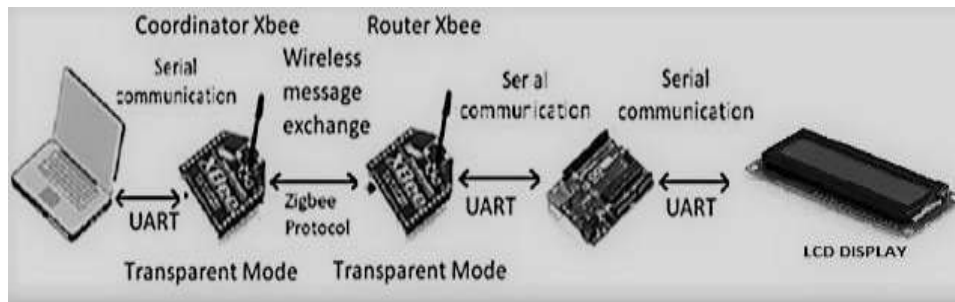
3.2. System hardware

Figure.2 System Hardware

4. PC to LCD COMMUNICATION OVER ZIGBEE PROTOCOL

4.1 INTRODUCTION OF OUTPUT

In the previous tutorial, Zigbee technology and its application in building wireless sensor network was discussed. In this tutorial, learn to perform simple Client to Client Communication over Zigbee Protocol. There will be two Zigbee modules taken and will be configured to communicate data with each other over the air.

The Zigbee devices communicate with each other wirelessly over the air. They can simply transfer the information what they receive. But they can be interfaced with other microcontrollers and processors like Arduino, Raspberry Pi or PC via serial Interface.

So, basically, Zigbee modules are capable of two types of communication - wireless communication and serial communication. The wireless communication takes place between Zigbee devices so that the devices act as radio frequency (RF) devices. For data to transmit and receive from one Zigbee module to another, both devices should be on same network. The data between two devices is transmitted wirelessly. By serial communication (UART), the Zigbee modules can communicate with microcontrollers and processors.

4.2 Interfacing the Zigbee modules

Zigbee modules operate on 3.3V with current of 40 mA to transmit and receive the data. Don't provide 5V from Arduino.

Zigbee modules have 3.3V tolerant signal level. For providing communication between arduino and Zigbee, use CMOS-to-TTL logic level converter (Bidirectional).

Sometimes when trying to discover Zigbee, there may occur an error like - 'Could not find any device in port COM6 >For input string: "ERROR" or error initializing device parameter = connection timeout or could not find device parameter' then the error may be because of the incorrect baud rate. For this, connect the modem using FTDI cable to the PC, open XCTU, select the COM port and multiple baud rates like 9600, 115200, 57600 then search for the radio module and possibly there the radio module can be found. But if not found, then open XCTU legacy (old version), select the possible baud rate and in the modem configuration window select the correct modem firmware/ function set, then enable 'always update firmware' and select write. After that, when the info box (action required) appears, then reset the Zigbee by connecting RST to GND or simply unseat the Zigbee and again place on seat. Now info box will disappear. It will then re-flash the radio modules automatically.

If there comes the error of baud rate difference then the error can be that the PC and radio module are not working on same baud rate. In such case, try to change the PC and flash the firmware with another PC. The Zigbee module can also be recovered this way.

4.3 software required

XCTU Software

4.3.1X-CTU SOFTWARE

This application note is intended to discuss the functions of Digi's XCTU software utility. Each function will be discussed in detail allowing a better understanding of the program and how it can be used. X-CTU is a Windows-based application provided by Digi. This program was designed to interact with the firmware files found on Digi's RF products and to provide a simple-to- use graphical user interface to them. X-CTU is designed to function with all Windows-based computers running Microsoft Windows 98 SE and above. X-CTU can either be downloaded from Digi's web site or an installation CD. When properly installed it can be launched by clicking on the icon on the PC.

V. Conclusion

The project deals with designing a simple and low cost wireless communiation system using ZIGBEE, LCD, BUZZER and ATMEGA-32 microcontroller unit to receives the desired from the transmitter and displayed it on the Liquid Crystal Diplay at distant location through SMS. The designed product module is at prelim stage and designed only for short message system but can be enhanced for communicating other different type of data and files, images, videos, which also can be cost effective.

By using these communication system we can easly communicate with each other without using any network and SIM(subscriber identity module) like Internet, Wi-Fi, Hi-Fi, etc..

Acknowledgements

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world. Possibilities and way to design and implement a ZigBee-based data transmission and monitoring wireless smart sensor network integrated with the Internet are considered and described in the paper. Implementing of a cost-effective such system requires the use and integration of different hardware elements and programming languages. Possibilities and key aspects of smart sensor nodes are considered and described in the paper. Design and implementation of an inexpensive energy saving Zigbee point-to-point wireless smart sensor network to monitor sensor data in energy efficient manner using Zigbee modules and different boards are proposed and described. Configuration of used Zigbee modules for smart sensor nodes communication is also described. Data measurement with such sensor nodes is also described. Results of wireless data measurement, data transfer and monitoring with such Zigbee based wireless smart sensor network via Web technologies are shown in the paper.

References

[1]. Wireless Sensor Networks: Concepts and Components (© Springer International Publishing Switzerland 2014 5 J. Cecílio, P. Furtado, Wireless Sensors in Heterogeneous Networked Systems, Computer Communications and Networks, DOI 10.1007/978-3-319-09280-5_2.
[2]. An Overview on Wireless Sensor Networks Technology and Simulation Software's , DOI 10.17148/IJARCCE.2016.55206 Vijay Kale, Rohit Kulkarni
[3]. https://www.arduino.cc/en/Main/ArduinoBoardUno
[4]. DIGI. Zigbee ® / Zigbee – PRO ® ZB OEM RF MODULES. 2008 http://www.digi.com.
[5]. HAND BOOK OF DISPLAY TECHNOLOGYJOSEPH A.CASTELLAND

[6].   Zigbee wireless networks and transceivers by SHAHIN FARAHANI