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Point To Point Voice Communication over Wireless Network Using Zigbee

N Preetha¹, S Retnakumar², B Subhasini³

^{1,2,3}Dept of Electronics and Communication Engineering, Karpagam Institute of Technology, Coimbatore, India

Abstract: There are different options to transmit the voice signals. A few of them are voice over internet protocol, radio frequency transmission etc. Normally ZIGBEE is used to transfer data between two nodes. In this proposed system a zigbee network is used for the transmission and reception of voice signals and forming a full duplex transmission. Here we use two zigbee modules one for the transmission another for the reception, the voice signals from the microphone is processed by the microcontroller and transmitted through the zigbee. The receiver zigbee will receive the signal and processed by the receiver's controller and will be played in the speaker. By this proposed system we can enhance the security of the voice communication over wireless medium.

Keywords: USART, PIC16F877A, Zigbee

I. INTRODUCTION

Wireless network is a network set up by using radio signal frequency to communicate among computers and other network devices. This network is getting popular nowadays due to easy to setup feature and no cabling involved. Wireless communication may be via: radio frequency communication, microwave communication, for example long-range line-of-sight via highly directional antennas, or short-range communication infrared (IR), short-range communication, for example from remote controls or via IRDA.

Zigbee is a specification for a suite of high level communication protocols using small, low power digital radios based on an IEEE 802 standard for personal area networks. The technology defined by zigbee specification is intended to be simpler and less expensive than other WPAN'S such as Bluetooth. Zigbee is targeted at radio frequency applications that require a low data rate, long battery life, and secure networking. Zigbee operates in 2.4GHz.

Zigbee is used to transmit the data between two nodes; these nodes may be two sensor nodes or a sensor node and a personal computer. For voice communications we use traditional phone networks, known public switched telephone networks (PSTN) are using circuit-switching resources are reserved along the entire communication channel for the duration of the call. The voice communication is carried out using the internet protocol(IP) this means of communication is called voice over internet protocol (VOIP) which is wired network, also the number of VoIP sessions by the network is low , therefore some methods should be introduced to increase the voice capacity. To overcome this drawback we can choose voice over zigbee which is wired free network.

II. Proposed Model

A. Proposed System

In the proposed system we use two zigbee modules one for the transmission another for reception. Zigbees which are used for

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transmitting data other than voice signals will be used to send voice signals in this proposed system. In general there is lack of security in RF transmission i.e. anyone can access the communication by tuning up to the same frequency which is used for that communication. Here in this system since we use zigbee each zigbee have its own pan id, zigbees can be mapped using their pan id to form a point to point and point to multipoint network. Therefore the communication will be between the mapped zigbees thus enhancing the security.

In our proposed system we have two major sections one for transmitting and the other is the receiving section. Each transmission and receiving section consists of a controller and a zigbee transceiver module. While the transmitting module has a microphone with amplifying circuit for getting the voice input, the receiver section has a speaker for the listeners to hear the transmitted voice.

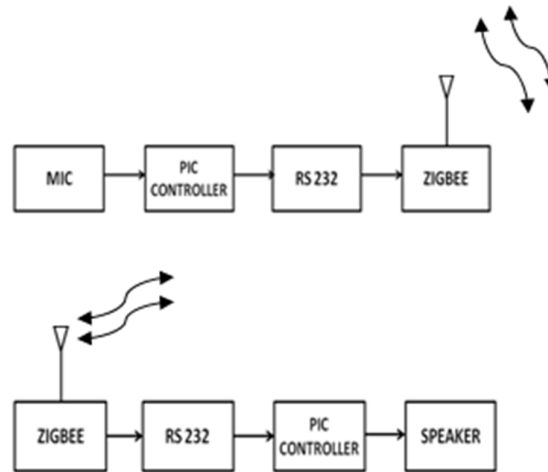


Figure1. Proposed Block diagram

B. Transmission Block

The transmission block consists of a microphone, PIC microcontroller, RS 232 interface and a zigbee for transmission.

Microphone and Amplifying Circuit

Here we are using a small condenser microphone which receives the voice signals and an amplifying circuit, which amplifies the received voice signals to the controller's analog input.

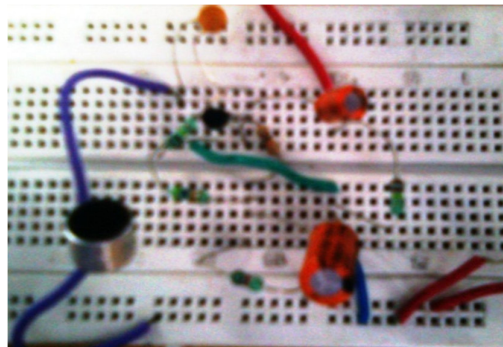


Figure 2: Mic with amplifier.

PIC Microcontroller

The PIC microcontroller used here is PIC16f877a; we choose this particular PIC because it has an inbuilt analog to digital converter (ADC), Universal Synchronous Receiver and Transmitter (USART) and also supports SPI and I2C. This PIC has a 10 bit 8 channel ADC, the PORTA of the PIC is used as the analog input pins. We use RS232 (USART) for transmitting the voice signals over zigbee.

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The audio or voice signals from the microphone is given as the input to the microcontroller. The controller further converts the analog signal to digital since it has an internal ADC. The digital signal is then transmitted wirelessly through the zigbee.

Zigbee Transceiver

Zigbee has been developed to meet the growing demand for capable wireless networking between numerous low-power devices. In industry Zigbee is being used for next generation automated manufacturing, with small transmitters in every device on the floor, allowing for communication between devices to a central computer. This new level of communication permits finely-tuned remote monitoring and manipulation. Due to its low power output, Zigbee devices can sustain themselves on a small battery for many months, or even years, making them ideal for install-and-forget purposes.

Since there are many zigbee is used to transfer the data. The zigbee used here for transmission of voice signals is zigbee TR24A which supports voice communication and low cost. It is single-chip transceiver. It is based on three wire digital serial interface and an entire phase-locked loop for precise local oscillator generation. It can use USART or SPI. It is a high performance and low cost module. It gives 30 metres range with onboard antenna. It provides extensive hardware support for the packet handling, data buffering burst transmissions and clear channel assessment.

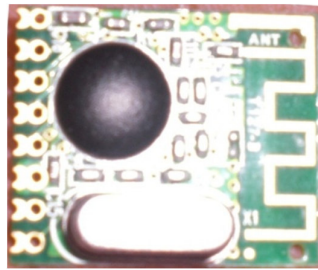


Figure3: TR24A

C. Receiver Block

The receiver block is same as the transmitter part. Except that instead of a microphone we have a speaker to play the voice signals. The transmitted signals are received by the receiver zigbee and forwards the signal to the microcontroller further the received signal is converted to the analog signal by using the carry compare module (CCMP) which is inbuilt with the controller.

We used inbuilt PWM module of the PIC as a DAC. PWM is really a good and cheap solution for DAC. Here, if we put an 8 bit data to CCPR2L register of PIC, it will generate PWM signal corresponding to that data. If we stream the voice data to CCPR2L with a speed according to the specified bit rate then a Pulse Width Modulated signal corresponding to the voice is generated which could be easily converted to analog signal by using a low pass filter. This could be amplified and introduced to a speaker to reproduce the voice. PWM out could be obtained from RC1/CCP2 pin of PIC16F877A.

D. Hardware Setup

In the transmitter side, the input voice signals are fed to the analog input of the PIC microcontroller where the signals get converted to digital since the PIC microcontroller is having an inbuilt ADC, the zigbee is connected to the TX and RX pins of the microcontroller since the transmission is using USART, and gets transmitted.

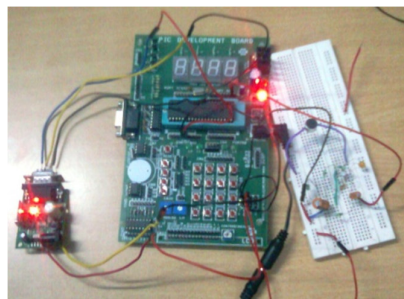


Figure4: Transmitter

The receiver side is same as the transmitter. The analog signal from the CCMP output from PIC microcontroller is fed to speaker via a low pass filter and an amplifier.

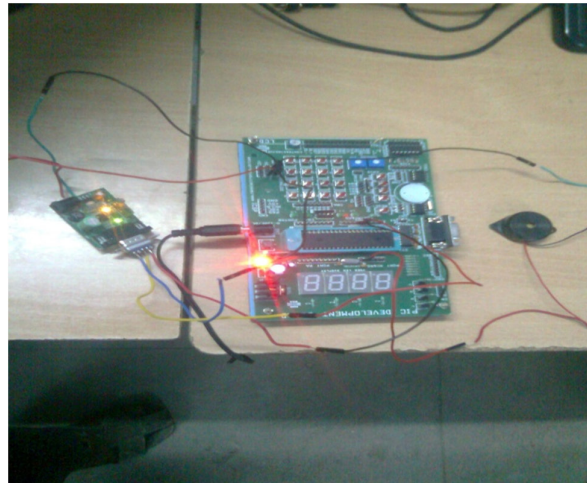


Figure5: Receiver

III. Conclusion

The wireless voice communication over the zigbee was done successfully using the USART. Since the received signal is facing some delay in reception we will be in need of implementing the entire transmission and reception using SPI protocol. We can further reduce the system by using a higher zigbee module which has an inbuilt ADC, thus reducing the need of a controller in the transmitter side.

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