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Voice call between Android devices using Wireless Sensors

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Abstract: *This paper describes the implementation of a peer to peer real time voice calling application in two android devices using wireless sensors with Zigbee as a network. The use of Zigbee technology between two android phones as IP phones, and their communication within a local wireless LAN is discussed in this paper. This proposed model is a form of telecommunication that allows exchange of data and voice via Wi-Fi network. The phones, which are Wi-Fi enabled and have android operating system, can be used to communicate with each other through the Wi-Fi communication channel .In this paper, we have used Speex voice codec on Android platform to implement voice call on devices with the help of Telos B motes.*

Keywords: *Android, Speex voice codec, TelosB motes, Voice communication, Wi-Fi, Zigbee.*

1. INTRODUCTION

1.1Wireless Sensors:

Voice over wireless sensor networks has seen a tremendous growth in both business and consumer sectors. Wireless sensor networks are of low cost and consumes less power, thus in this paper those are used to transmit moderate quality of voice signal through Zigbee network[1]. Crossbow's TelosB Mote TPR2420 is an open-source platform designed to enable cutting-edge experimentation for the research community. The TPR2420 bundles all the essentials for lab studies into a single platform includingUSB programming capability, an IEEE 802.15.4 radio with integrated Antenna, a low power Micro Controller Unit (MCU) with extended memory and an optional sensor suite[1].

1.2 Zigbee Technology:

Zigbee technology consists of a suite of specifications designed particularly for wireless network sensor and controllers, based on IEEE 802 standard for personal area network [2]. Zigbee is used for audio applications because of the following advantages:

1. Zigbee has a data transfer rate of 250 kbps and the data rate required for the transmission of audio signal, mainly varies from tens of kbps to hundreds of kbps, making Zigbee an alternative for low end and mid end applications.

2.Zigbee is well suited for transmission of regular and irregular data or a single signal transmission from input device or sensors[2].

3.Zigbee with wireless sensors can last for years without change in battery.

4.The software size of Zigbee stack is only 1/10 (one tenth) of a Bluetooth stack.

Section 2 describes the existing systems related to voicecommunication, In section3& 4,we describes the proposed service and implementation of the proposed system, In section 5 we describes the experimental results obtained.

2. EXISTING SYSTEM

The existing service in [3] presentsan internet based communication system that allows android based device users tosend and receive messages via Wi-Fi.Fig1describes the configuration for transmission of messages between two devices. The following are the draw backs from the above service:

1. It requires internet connection
2. It provides only messaging service
3. It does not provide call transfer service

The existing service in [4] provides voice call using VOIP protocols but it has some disadvantages:

1. Third-party software typically must be installed on handsets.
2. Multiple numbers or special IDs are required to make Wi-Fi calls.
3. Messaging and conferencing are typically not supported.

The existing method implemented in [5] does not provide real time voice calling service.

Figure 1: System Configuration for message Transfer

3. PROPOSED SYSTEM

To implement this proposed system, the Tablet with android source code compatibility was interfaced

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with TelosB mote using USB (Universal Serial Bus) cable. Tablet uses packet-less serial communication to communicate with the TelosB mote. The TelosB motes communicate through packet based radio communication using Zigbee [1]. For this proposed system, we developed an Android application for communicating with TelosB mote. Speex Codec is used for coding and decodingrecorded voice received from microphones. Android APIs are developed to provide the software required for implementing this service.

4. IMPLEMENTATION

4.1 Speech Encoding:

The voice data from the microphone is handled using AudioRecord Android API (Application Program Interface).The sampling rate is kept at 8 Kbps.The audio encoding format used is 16 bit PCM (Pulse Coded Modulation). The buffer size is 4096 bytes for the above mentioned sampling rate and recording format. The recorded data is written into a temporary file in frames of size 4096 bytes [6].

Speex voice codec is used for compressing the voice data so that it can be transferred over low bit rate IEEE 802.15.4 standard. Speex encoder operates in frames. A frame contains raw voice data corresponding to 20 ms of voice. These frames are read from the temporary file (created while recording voice) and given as input to the Speex encoder, which compresses the given frame and returns 38bytes of encoded voice data. Now the 38 bytes of encoded voice data is written into a file, which will be later used by the Serial communication part.

4.2 Speech Decoding:

At the receiving end, 38 bytes of encoded voice data is received from TelosB. Every time 38 bytes of data is received, it is stored in receive buffer and this buffer is given as input to the decode method, which decodes the data and returns 320 bytes of voice data. These 320 bytes are stored in a dynamic buffer and every time after decoding 38 bytes; 320 bytes are appended to this dynamic buffer.

This dynamic buffer is used for playing the voice. Write and Play methods of AudioTrack Android API are used for this purpose. When 320 bytes are decoded for the first time, Play method is initiated and starts playing thevoice. Write method is used for writing the data from dynamic buffer to play method. As the dynamic buffer will be modified every 20 ms, the voice will be played in real time until the sender ends the voice call [7].

4.3 Voice Transmission:

Android device and TelosB mote communicate using serial communication at a baud rate of 115.2 Kbps. The micro USB port of Android device is connected to the USB port of TelosB mote using OTG cable. The Figure 2 describes the voice transmission between two devices.

Device API provides write method to send the encoded data to the USB port. To make the communication real time, we are using a thread for reading 38 bytes of encoded data from encoded file and writing it to the micro USB port every 20 ms.

Along with this 38 bytes of data, an extra byte containing the destination node id is sent before 38 bytes, which will be used by TelosB for further processing [8].

TelosB mote sends data byte by byte to the micro USB port. These bytes are stored into a buffer queue.When the length of the buffer reaches 38 bytes, these 38 bytes of data are read using Read method and loaded into a byte array. This byte array will be used by the decoding section.

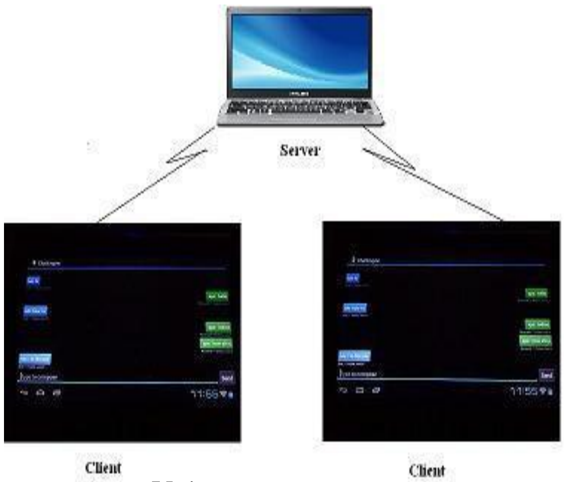

Figure 2: Voice call between two devices

4.4 Packet based Radio Communication:

TelosB motes communicate through packet based radio communication. For this demo, TinyOS v2.1.2 platform is used for programming TelosB motes. TinyOS program handles Serial communication with Android device and Radio communication between two motes[4].

The TinyOS interface used is Uart Stream which provides Send method for sending data and an event Receivedbyte which signals the receipt of a byte. As and when Android devices starts sending data, Receivedbyte event is triggered which stores the received byte into a buffer. When the buffer size reaches 39 bytes, this data will be processed and used to form a packet and is sent over radio. For sending the received data from other mote, Send method is called. Send takes pointer to the stored received data and length of the data to be sent [9].

4.5 Mote to mote communication:

TelosB uses cc2420 radio for communicating with other motes. cc2420 uses CSMA/CA as default MAC layer. This communication is purely packet based.For sending the packet, we used Send method provided by AMSend interface. Send method can broadcast the packet or it can send it to a particular destination by writing the destination node id in the address field of the method. For receiving data from other motes, AM receive interface is used. This interface provides an event called Receive for handling the received packets. This event parses the received packets and

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extracts the data from it. The extracted 38 bytes of data is sent to Android device using Uart Stream interface [10].

5. RESULTS

The Figure 3 shows the user interface layout of the application that contains a text view, a text box and three user buttons. Text view gives the instructions of operation. Text box is to input the destination node id which is given to each Telos B mote. After writing the destination node id in the text box, click on Enter destination button. After that by clicking on Record button the voice call is initiated. Stop button is used to end the voice call.

Figure 3: User interface layout

6. CONCLUSION

In this paper, we implemented real time voice calling on Android devices with Zigbee as underlying communication standard. The user handset developed in this paper is Android device interfaced with TelosB mote, both are popular and cheaply available in the market. We can easily extend this peer to peer half duplex voice communication to full duplex voice communication over a network which can cover an entire village. This application can also be extended to support file transfer as they need not be done in real time. This kind of network is likely to be very useful to the people in underdeveloped areas, companies, industries etc.

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