

Design and Implementation of Embedded Bluetooth Multicast System

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Abstract—:

Enhance Data Rate (EDR) in Bluetooth 2.0 specifications provide condition for Bluetooth multi-point communication. Aiming at application requirements of Bluetooth technique in wireless communication, Embedded Bluetooth Information Broadcast System (EBIBS) based on ARM9 microprocessor S3C2440 was designed and implemented. The system runs on ARM-Linux operation system and achieves single point transmission, multi-point transmission and information update based on Bluetooth 2.0 specifications. BlueZ protocol stacks and object exchange (OBEX) were utilized to complete multi-point transmission. The information to be broadcasted is updated using Bluetooth dongle connected to pc. The system has been verified at broad-level and practical application. The result was also provided.

Keywords-Bluetooth; ARM; embedded; information broadcast, Bluetooth Dongle.

INTRODUCTION

Bluetooth is an open standard for wireless data and voice communication [1]. As a short-range wireless communications technology standard, Bluetooth technology has been widely applied in wireless communication field as personal communications devices, wireless network communication and various transmission systems for its advantages of low cost, low power, small size and etc [2]. The intelligent and

Multimedia trend integrates embedded computer system and wireless communication application has become increasingly clear, both wide-area mobile communications and short-range communication

technology have played a pivotal role in information society. Embedded Bluetooth application that integrates

Embedded technology and Bluetooth communication is one of development directions currently and future Traditional Bluetooth communication based on 1.0 specification only supports unicast. As Bluetooth technology develops, the Bluetooth 2.0 specifications add EDR technique to improve throughput of Bluetooth data transmission and provide condition for multicast transmission. Bluetooth devices. Information broadcast and information update with Bluetooth provides broad development space for advertisement and other industries related to information publish.

II. SYSTEM FUNCTIONS AND ARCHITECTURE

A. Overall Framework

The designed EBIBS mainly complete two functions, namely information broadcast and information update. The information broadcast completes the task that sends information to multiple Bluetooth devices around EBIBS at the same time, mainly including information unicast and multicast. Information update achieves network communication between EBIBS and PC.

B. Hardware Framework

The EBIBS is based on ARM hardware development platform and uses Samsung S3C2440 [5] as core processor. The micro-processor constitutes core embedded system with 64MB SDRAM and 64M Flash. It

runs ARM-Linux-2.6.12core operation system, where Bluetooth bus-system is configured to provide driver for USE Bluetooth adapter. As core communication component, Bluetooth adapter connects to USB device interface. LED and key constitute hardware part of user interaction interface. The system is easy to extend function and migration system. Developers can download operation system core and upper applications to SDRAM or Flash via USB Host interface and debug applications with RS-232 serial port. The blue tooth Dongle is connected to PC.

BLOCK DIAGRAM:

MINI2440A

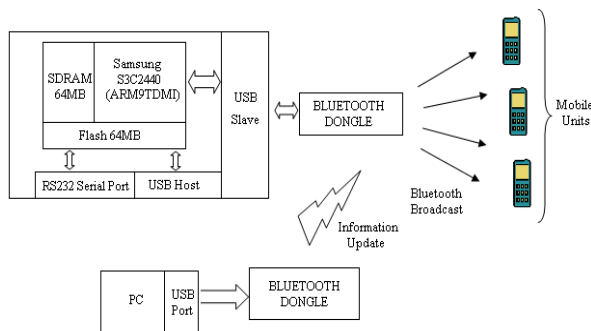


Figure1. EBIBS architecture

c. Software Framework

Software framework can be divided into two main modules, namely information broadcast module and information update module. The information broadcast module can be further divided into three sub-modules: information management module, device query module and information transform module. Information management module is responsible for sorting information so that user can send it in specific order.

The device query module uses Service Discovery Protocol (SDP) to obtain information of surrounding Bluetooth devices service and automatically filter remote device with object push service as discovery objects. As core module, information transform module complete information broadcasting. LED driver and key driver are added into system to provide lowlevel software support for user interaction functions.

Multicast Implement

Multicast transmission uses TDD and EDR technologies in Bluetooth protocol to implement information transmission from system to multiple Bluetooth devices. Meanwhile, multiple process technique is used to reasonably manage multiple transmission processes, so that the information can be sent to remote device effectively and promptly. The TDD technique is used so that multiple devices can share a physical channel. Data is packet and sent in time division multiplexing manner. The EDR technology increases transmission

Bandwidth and transmission rate of Bluetooth data so as to improve information multicast transmission efficiency.

The multicast transmission process is shown in Fig. 2.

Firstly, information transmission parent process creates childprocesses whose number is equal to that of Bluetooth devices. Each sub-process independently undertake task that send information to Bluetooth device so that information can be broadcasted to multiple devices.

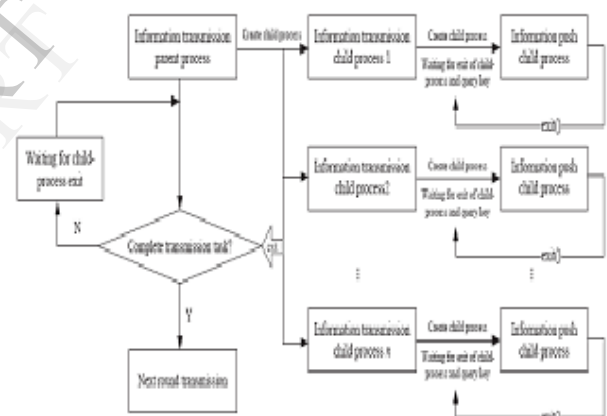


Figure2.Multicast transmission

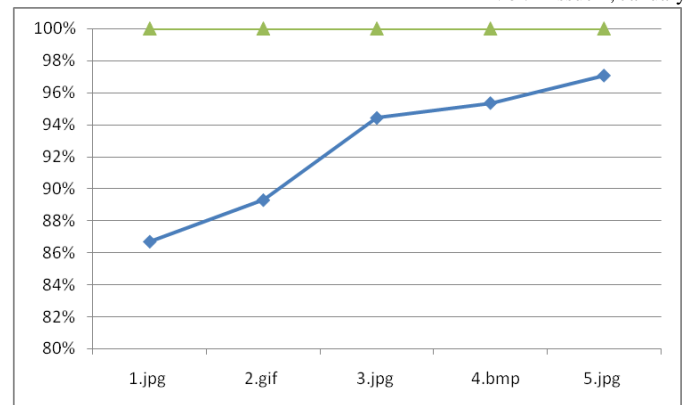
IV. INFORMATION UPDATE IMPLEMENT

Information update function uses PAN technique to establish network communication between broadcast system and PC. In the Bluetooth network, the client is called PAN or PANU, while server provides two kinds of services (Network Access Point) NAP and (Group Network)GN. In EBIBS, NAP is used for networking. There are only three

devices in the network, namely PC, broadcast system and Bluetooth.

File Multicast Test

The experiment is mainly used to test connect reliability and file transmission time. (1) Compare connect success ratio before and after adding retransmission mechanism to show the importance of retransmission mechanism on improving reliability of multicast. The method to compute connection success rate is as follows: Connection success rate = number of successful connections/(information number in each group × number of device) × 100%. Firstly, we tested connect success rate between test system and remote device before retransmission mechanism was added. Taking mobile phone as receiver client, the result is shown in Fig. 3. The results show that the connection success rate is only 53.33%, which can not meet actual needs. Added retransmission mechanism, connect success rate is up to 100% in all cases. The connection reliability is significantly improved to meet application



CONCLUSION

The paper implemented BlueZ protocol stack and Open OBEX function library based on ARM-Linux with ARM hardware platform. The information broadcast and update function was achieved based on Bluetooth 2.0 protocol. The focus is on information unicast and multicast. The EBIBS is low cost, high reliability, real-time and can be flexibly extended. It also has good portability and interactive features. The program can be applied to variety municipal and public place propaganda system combining with multimedia Technologies. It can also be used form publish of commercial

TABLE I

File size/KB	Average	transmission	time/s
1.jpg	86	2.9	13.2
2.gif	100	6.91	12
3.jpg	223	8.5	13.2
4.bmp	229	10.2	11.2
5.jpg	336	13.2	10.2

Figure 3 Test of connection success rate

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