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Implementation of Broadcast Information System using Bluetooth Technology (BIS)

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Abstract:- *Broadcasting the Information to devices using Enhanced 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,it is implemented on ARM9 controller S3C2440. The system runs on ARM-Linux operation and achieves single point transmission and multi-point transmission based on Bluetooth 2.0 specifications. BlueZ protocol stack and object exchange (OBEX) were utilized to complete multipoint transmission. The system is verified at broad-level and practical application. The result is included.*

Keywords:–Bluetooth,ARM, Information Broadcast.

1. Introduction:

In wireless communications we have several technologies like Bluetooth, ZigBee, Wi-Fi and etc. Due to low speed constraint in ZigBee,it is difficult to transmit heavy files and Wi-FI, the structure is complex, power consumption is high and expensive. For its advantages of low cost, low power, small size and etc Bluetooth technology is widely used.

Bluetooth is an open standard for wireless data and voice communication. 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. Embedded Bluetooth System is integrated withEmbedded technology and Bluetooth communication, which is one of development directions currently and future. Traditional Bluetooth communication based on 1.0 specification only support 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 communication.

2. Description:

2.1 Bluetooth 2.0

It supports Broadcast/multicast. Non-hopping channels are used for advertising Bluetooth service profiles offered by various devices, since there is no need to perform handshaking with every device. Enhanced data rate of 2.1Mbit/s. The table of comparison among wireless network is shown below.

	ZigBee	802.11 (Wi-Fi)	Bluetooth	Wireless USB
Data Rate	20, 40, and 250 Kbits/s	11 & 54 Mbits/sec	1 Mbits/s	62.5 Kbits/s
Range	10-100 meters	50-100 meters	10 meters	10 meters
Networking Topology	Ad-hoc, peer to peer, star, or mesh	Point to hub	Ad-hoc, very small networks	Point to point
Operating Frequency	868 MHz (Europe) 900-928 MHz (NA), 2.4 GHz (worldwide)	2.4 and 5 GHz	2.4 GHz	2.4 GHz
Complexity	Low	High	High	Low
Power Consumption	Very low	High	Medium	Low
Security	128 AES plus application layer security		64 and 128 bit encyption	
Other Information	Devices can join an existing network in under 30ms	Device connection requires 3-5 seconds	Device connection requires up to 10 seconds	

Fig 1: comparison between wifi technologies

The Bluetooth specifications:

Specifications	Bluetooth 1.1	Bluetooth 1.2	Bluetooth 2.0	Bluetooth 2.1 plus EDR (Enhanced Data Rate)	Bluetooth 3.0	Bluetooth 4.0
Voice dialing	Yes	Yes	Yes	Yes	Yes	Yes
Call mute	Yes	Yes	Yes	Yes	Yes	Yes
Last-number redial	Yes	Yes	Yes	Yes	Yes	Yes
Improved resistance to radio frequency interference		Yes	Yes	Yes	Yes	Yes
10-meter range	Yes	Yes	Yes	Yes	Yes	Yes
100-meter range			Yes	Yes	Yes	Yes
Fast transmission speeds			Yes	Yes	Yes	Yes
Lower power consumption			Yes	Yes	Yes	Yes
Improved pairing (without a PIN)				Yes	Yes	Yes
Greater security		Yes	Yes	Yes	Yes	Yes
Bluetooth Low Energy						Yes
NFC Support			Yes	Yes	Yes	Yes

Fig 2: Bluetooth Specifications

2.2 ARM 9 S3C2440

The S3C2440A is developed with ARM9 core. Around 1.2V internal, 1.8V/2.5V/3.3V memory, 3.3V external I/O microprocessor with 16KB I-Cache/16KB DCache/MMU.

Features:

- CPU: Samsung S3C2440A(ARM920T), 400MHz, max. 533MHz.
- RAM: 64MByte SDRAM, 32bit Bus, 100MHz clock.
- Flash: 64MByte or 128MByte Nand Flash and 2MByte Nor Flash with Bios.
- System Clock: 12Mhz Crystal.
- LCD: 4 wire resistive touch screen interface
- Power Supply: 5V Connector
- Dimension: 10 x 10cm.
- OS support: Linux 2.6, Andriod, Windows

2.3 Root File system

The root file system is the file system that is contained on the same partition on which the root directory is located and it is the file system on which all the other file systems are mounted as the system is booted up.

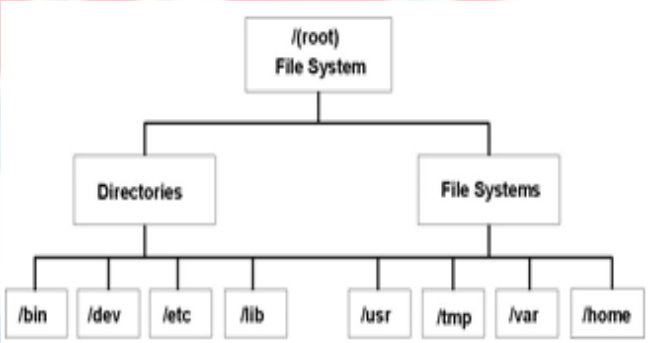

Fig 3: Root File System Structure

2.4 Boot loader

A boot loader is a computer program that loads the main operating system or runtime environment for the computer after completion of self- tests.

3. Implementation:

The basic block diagram of BIS is as follows:

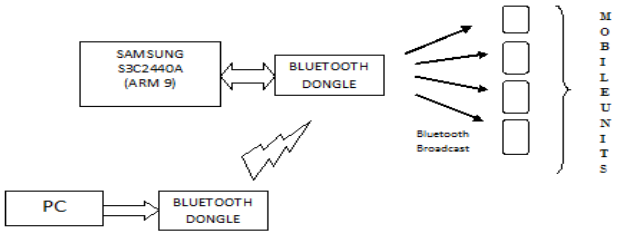

Fig 4: Block Diagram of Broadcast Iformation System using Bluetooth Technology

The Block diagram represents two types of data transmission i.e., Unicast and Multi cast.

3.1 Unicast Implementation:

Unicast implementation for Information Broadcast is the core of design. It is required to use Bluetooth dongle to both sender and receiver. Here sender will pass the data to Bluetooth dongle which performs several protocol related operations like fragmentation, packet encapsulation, frequency hopping along with the proper security operations.

At the receiver side Bluetooth Dongle receives the encapsulated packets from wireless media and then concatenates with reference to the sequence numbers and then frames a single packet with all the verifications of security aspects.

3.2 Multicast Implementation:

In multicasting sender device is going to send a single packet to multiple receivers, which may contain Bluetooth module internally. For the devices which doesn't have Bluetooth module internally, it is required to connect a Bluetooth dongle externally. So sender will scatter the information among multiple receivers. It uses BlueZ stack and OBEX for broadcasting.

3.2.1 BlueZ stack:

The Bluez is the Bluetooth stack for Linux. "hidd" is the Bluetooth human interface device (HID) daemon. Bluetooth is defined as a layer protocol architecture consisting of core, cable replacement, telephony control and adopted protocols. Mandatory protocols for all Bluetooth stacks are: LMP, L2CAP and SDP. In addition, devices that communicate with Bluetooth almost universally can use these protocols: HCI and RFCOMM.

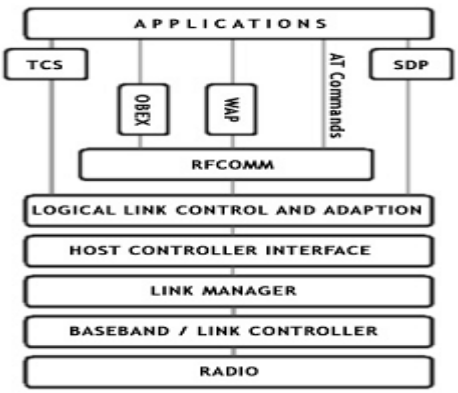

Fig 5: Bluetooth stack

3.2.1.1 LMP:

The Link Management Protocol (LMP) is used for control of the radio link between two devices, implemented on the controller.

3.2.1.2 L2CAP:

The Logical Link Control and Adaptation Protocol (L2CAP) used to multiplex multiple

logical connections between two devices using different higher level protocols.

3.2.1.3 SDP:

The Service Discovery Protocol (SDP) allows a device to discover services offered by other devicesand their associated parameters. Each service is identified by a UniversallyUniqueIdentifier (UUID).

3.2.1.4 RFCOMM:

Radio Frequency Communications (RFCOMM) is a cable replacement protocol used to create a virtual serial data stream, which provides a simple reliable data stream to the users. It is atransport layer for OBEX over Bluetooth.

Many Bluetooth applications use RFCOMMbecause ofits widespread support and publicly available API on most operating systems. Additionally, applications that used a serial port to communicate can be quickly ported to use RFCOMM.

3.2.2 OBEX:

Object Exchange Protocol (OBEX) is a session layer protocol for the exchange of objects. The OBEX conversation occurs within the context of an OBEX connection. The connection oriented session allows capabilities information to be exchanged just once at the start of the connection, and allows state information to be kept.

Once a request is issued, the client waits for a response from the server before issuing another request. The request/response pair is referred to as an operation.

3.2.3 Flow chart:

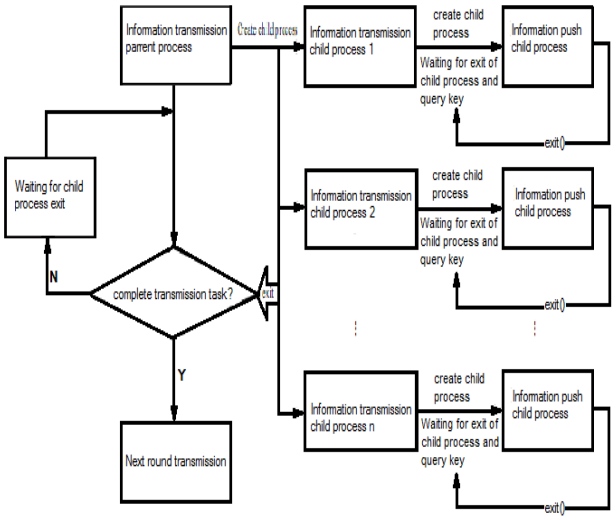

Fig 7: Flow chart of multicasting

4. Results and Discussions:

The Bluetooth dongle which is connected to ARM broadcasts the information to mobile devices which are in queue.

Fig 8, shows that the system was searching for the nearby devices with Bluetooth on and also looks for the object push profile to push the object through OBEX.

Fig 8: searching for near by devices

The following images show the file transfer to multiple mobile devices.

Mobile 1:

Mobile 2:

The following fig shows the file transfer to multipe devices and after the successful transmission, the connection is disconnected.

Fig 9 : File transfer to multiple devices

Once the transmission is done for every output device which is in queue, the system will wait for 60 seconds and starts broadcasting the information.

V. CONCLUSION:

The project "Implementation of Broadcast System using Bluetooth Technology" has been successfully designed and tested. It implements BlueZ protocol stack and OpenOBEX function library based on ARM-Linux with ARM hardware platform. The information broadcast and update function is achieved based on Bluetooth 2.0 protocol. The focus is on information multicast. It is low cost, high reliability, real-time and can be flexibly extended.

VI. Future Scope:

The existing System can include the following application:

1. It can receive multiple files using multiple stacks.
2. Selecting devices from the system and broadcasting the information.
3. Using single stack, multiple reception of files can be done.

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VIII. Bibliography:

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