

Design and Implementation of a Voice Broadcasting System from a PC to Mobile Devices

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ABSTRACT

Mobile technology is rapidly developed, this developing leads the production of the multimedia smartphone that supports wireless LAN (WLAN) that are widely deployed because of its ease of use, flexibility, sharing application and support for multimedia transmission.

In this paper, a system was designed and implemented to stream audio from the computer and displayed it on the smartphone model using the (Client\ Server) model.

This work deals with real-time audio, using real-time streaming protocol (RTSP), the proposed work has achieved success of sending voice over the wireless network environments via heterogeneous operating system, Linux and Android.

Keywords: Android, Audio Stream, Linux, Wireless, Smartphone, VLC.

تصميم وتنفيذ نظام البث الصوتي من الكمبيوتر الشخصي إلى الأجهزة المحمولة

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المخلص

تشهد تكنولوجيا الهواتف النقالة تطوراً سريعاً، وقد أدى هذا التطور إلى ظهور الهاتف الذكي متعدد الوسائط والذي يدعم الشبكات المحلية اللاسلكية (WLAN) المنتشرة بشكل واسع لما لها من المرونة والسهولة ومشاركة التطبيقات ودعم ترانس الموائم المتعددة.

تم في هذا العمل تصميم وتنفيذ نظام يقوم ببث الصوت من الحاسوب وعرضه على الهاتف الذكي باعتماد نموذج المستفيد/ الخادم (Client\ Server).

يتكون النظام من برنامجين، صمم البرنامج الأول والذي يعمل على الحاسوب الخادم بلغة (C++) ويعمل تحت بيئة نظام التشغيل (Linux Mint) وهو يقوم بإرسال الصوت بالوقت الحقيقي على الشبكة اللاسلكية وذلك باستخدام مكتبة (Live555) والتي تستخدم لتدفق الوسائط المتعددة، مبدأ العمل تطلب قراءة وتحليل بيانات الصوت في (Linux) إما من ملف صوتي اعتيادي أو من بث مباشر عن طريق استخدام اللاقط.

أما البرنامج الثاني والذي يعمل على الهاتف الذكي المستفيد فقد صمم بلغة جافا اندرويد (Java Android) ويعمل تحت بيئة نظام التشغيل اندرويد (Android) بإصدار خبز الزنجبيل (Gingerbread 2.3.3) ويقوم هذا البرنامج باستلام الصوت من الشبكة اللاسلكية وعرضه على أكثر من جهاز بالوقت الحقيقي.

تم في هذا العمل التعامل مع الصوت بالوقت الحقيقي وذلك باستخدام بروتوكول تدفق الوقت الحقيقي (RTSP)، وقد حقق البحث نقل الصوت بكفاءة جيدة عبر الشبكة اللاسلكية وباستخدام بيانات مختلفة من نظم التشغيل.

الكلمات المفتاحية: الاندرويد، بث الصوت، لينكس، اللاسلكي، الهاتف الذكي، VLC.

1. Introduction

The manipulation with the stream of multimedia over wireless channels are always challenging issue, due mainly to the communication protocols that must be effective and strong loss of wireless networks. In addition, battery life and capacity calculation and design of important determinants of mobile phones and the widespread tools that must be addressed to the multimedia content growing. Wireless sensors have gained in recent times a growing interest in the importance of embedded computing platforms [4].

A group of researchers (Arun Kumar BR, Lokanatha C. Reddy, Prakash S. Hiremath and Naresh.SS) in India 2008, research focused on the application layer by taking advantage of the Protocol (RTSP), which controls the data transmission (Multimedia) in real time, also confirmed to take advantage of this Protocol to send data (Multicast) to set any specific manner (one-to-many), as well as the advantages of this protocol is the division of data into a set of packets sizes be appropriate depending on the range between the client and server, the program user to view a particular packet and decompression the package to open a second while it loads a third package [2].

Description of the researchers (Dajun WU, Jianping CHEN and Xiaoming BAO) in 2011, an innovative system for the smooth flow of music from the type (MPEG-4 SLS) applies to mobile devices over the internet without a loss, using a technique (DirectShow) to the beneficiary, streaming high-quality music to the mobile as a basic model for the next generation system was used (Streaming Server) for the server and (Windows Mobile OS) receipt of the mobile devices [16].

In this paper, two programs are designed and implemented as follows: the first program to send audio from a computer server by means of a microphone to record the audio and stream the audio over the wireless network. The second program shall be in smart phones and the receipt audio from a computer server over the wireless network and review of that voice or music.

2. SmartphoneDevices

Smartphone is the kind of device that combines the functionality of the mobile phone and PDA (Personal Digital Assistant) [14]. The current mobile multi-purpose devices, is one of the strongest and appropriate for many activities [13].

The convergence of mobile telephony, Internet services, and personal computing devices is resulting in the emergence of a “mobile Internet” [7].

The key devices for accessing the mobile Internet currently dubbed “smartphones” are powerful new computing devices offering traditional wireless voice service as well as native software applications and, perhaps most importantly, the ability to connect to and run a myriad of Internet-based services including email, geo-location, streaming video, and social networking, while providing a good user experience. [10]. The original design of cell phones is getting more and more versatile, which is originally designed for voice communications, cell phones can now do much more than just make phone calls. Today’s cell phone can include a Web browser, camera or camcorder, music or video player, modem, GPS navigator, gaming device, or radio or TV receiver. [15].

3. Android OS

Android is the newest operating system that will be discussed. The first public beta version was released on 12 November 2007, but the first mobile phone with the

operating system did not see the light until 23 September 2008. The Android operating system is developed under the umbrella of Google and is at the core based on Linux.

Android is being developed by the coalition is open to mobile phones (Open Handset Alliance) which is operated by Google. There are currently more than 520,000 application for Android is available in the Android Market, a shop is available on the Internet is run by Google [8,17 and 18].

In an Android system architecture, there are several layers between the core Linux operating system and application layer, as can be seen in Figure (1).

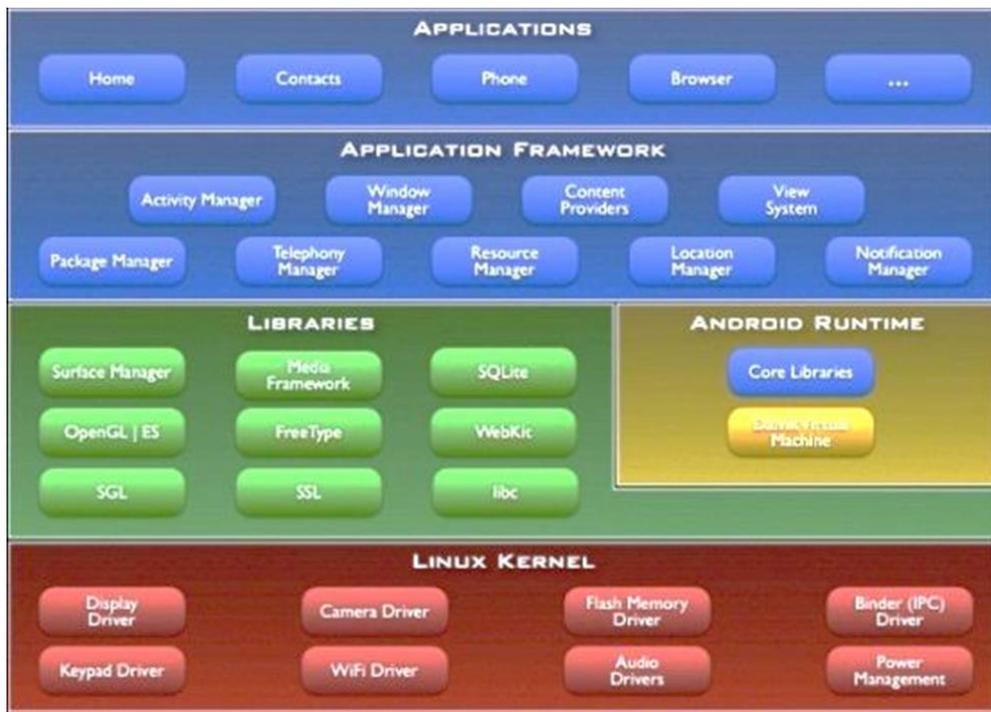


Figure (1). Overview of Android Operating System Architecture

4. Sound System

Open Sound System, or (OSS), was developed in the original, not only for the operating system (Linux), but for a number of derivatives of the system (Unix) different. While, successful for a long time this simple architecture, but to some extent suffers a number of problems, most important for the average user is the inability to post the audio device between different applications. As an example, users of computers can't listen to the notification sounds, while another sound exists such as playing music in the background. The background music prevents all other sounds to be played. Along with a number of non-technical reasons that ultimately led to the development (ALSA). With the onset of (Linux 2.6), becomes (ALSA) audio subsystem record (Linux), although the technique (OSS) is still available as an option obsolete, the reason is the lack of drivers support for this technique to some old audio devices. These features allow the devices in conjunction audio between applications, most likely support the applications of modern technology (ALSA) or which are included and many of the current applications that make the conversion to older sound frameworks [12 and 19].

5. StreamingMedia

Media streaming is the process of playing audio or video while being downloaded from Internet. It enables users to play media without having the media file locally stored. In the process, web servers contain the references of the media stream

files hosted on different media servers or networks. When a user clicks on the link, a media server or network streams the content directly to the user. Here, media contents are stored on a different host or network, therefore, streaming does not have any impact on the web servers [9].

Media streaming often refers to the transfer of audio and video data, by which they can be applied to any other type of data, such as still images and text and changes to the data is in an orderly, sequential, and logically. Streaming media usually includes the interpretation of those data in real time through some of the rankings on applications, and usually these applications to be "multimedia player", such as multimedia player in Windows (Windows Media Player) and media player (VLC), which is an open source and runs on a Linux system [6].

A complete media streaming system works by creating, delivering and at the end playing the media at the client player. The key elements involved to accomplish the whole process are: capturing, encoding, editing, serving and playing [5].

RTSP is an application layer protocol which is designed to work with lower layer protocols like the RTP to provide streaming service over the internet. It is simply a client-server multimedia protocol to enable controlled delivery of streamed data over IP network [3]. It acts as "network remote control" for multimedia servers [2]. In RTSP, the client controls the media server by providing "VCR-style" remote control functionality like "play" and "pause" ... etc. The delivery mechanisms are based solely on the RTP. RTSP takes the advantage of streaming by which multimedia data is usually sent across the network in streams, instead of storing large multimedia files first and then perform playback. By streaming, data is broken down into packets with size suitable for transmission between the servers and clients. This data then flows through the transmission, decompression and playback pipeline just like a water stream. A client can play the first packet; decompress the second, while receiving the third . Thus the user can start enjoying the multimedia without waiting to the end of transmission to get the entire media file. Both live data feeds and stored clips can be the sources of data [5].

6. Wireless Network

Wireless network technology (Wi-Fi) is one of the most important topics in the field of mobile computing. Everyone has an opinion on the case of third-generation wireless networks (3G), Bluetooth and the impact of personal networks, and wireless local area network technology that will dominate the market. Although, not all mobile applications require wireless connectivity, there is no doubt that wireless technology is one of the main forces driving mobile computing [11].

(IEEE 802.11) is a set of standards for the implementation of wireless local area network (WLAN) communication for (2.4, 5) GHz frequency package. These standards are the foundation for wireless networks equipped for wireless network products, which owns the trade name (Wi-Fi) [1].

7. System Architecture

In this paper, the programs are designed and implemented to send audio simultaneously with minimal delay, these programs work in a wireless network that contains heterogeneous operating systems. Streaming audio system architecture which is explained in (Figure 2).

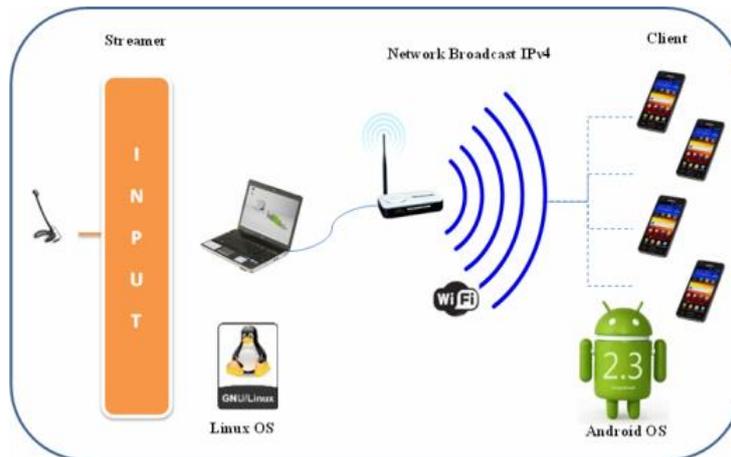


Figure (2). Streaming Audio System Architecture

Streaming of data have been sent by wireless network from a server computer by appropriate communication protocols in order to receive by smart phone on the other side. Presentation of streaming data takes place and consider into account the consistency in the protocols of communication, which means sending and receiving data to provide means of communication protocols and methods for reducing the size of the data. This to meet the requirements of receiving less delay sound. Figure (3) clarifies the design system stages. Two programs are designed and explained in the next two sections (7.1 and 7.2) respectively.

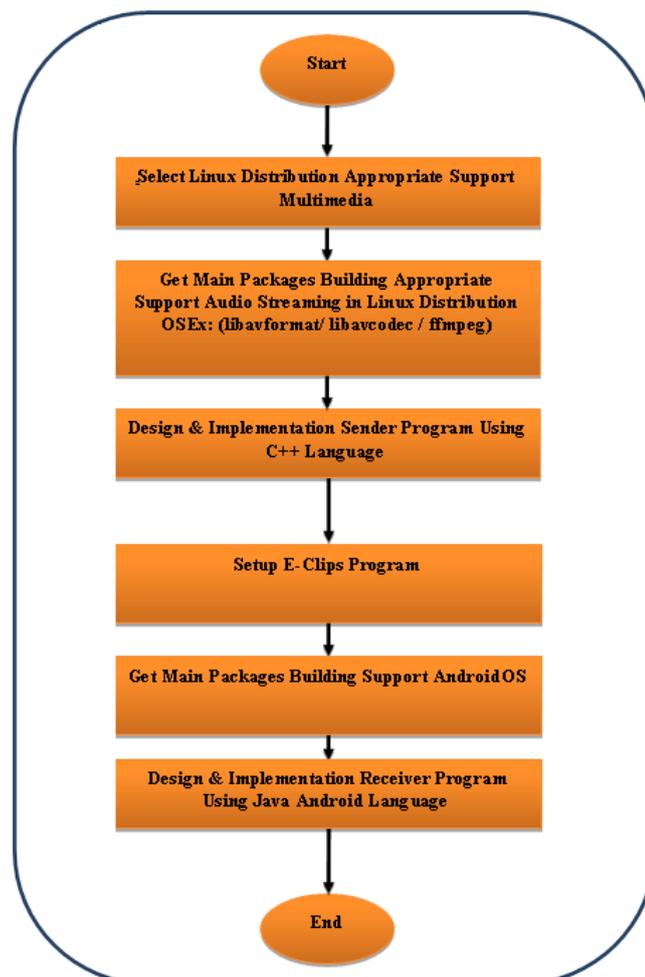


Figure (3). Design System Stages

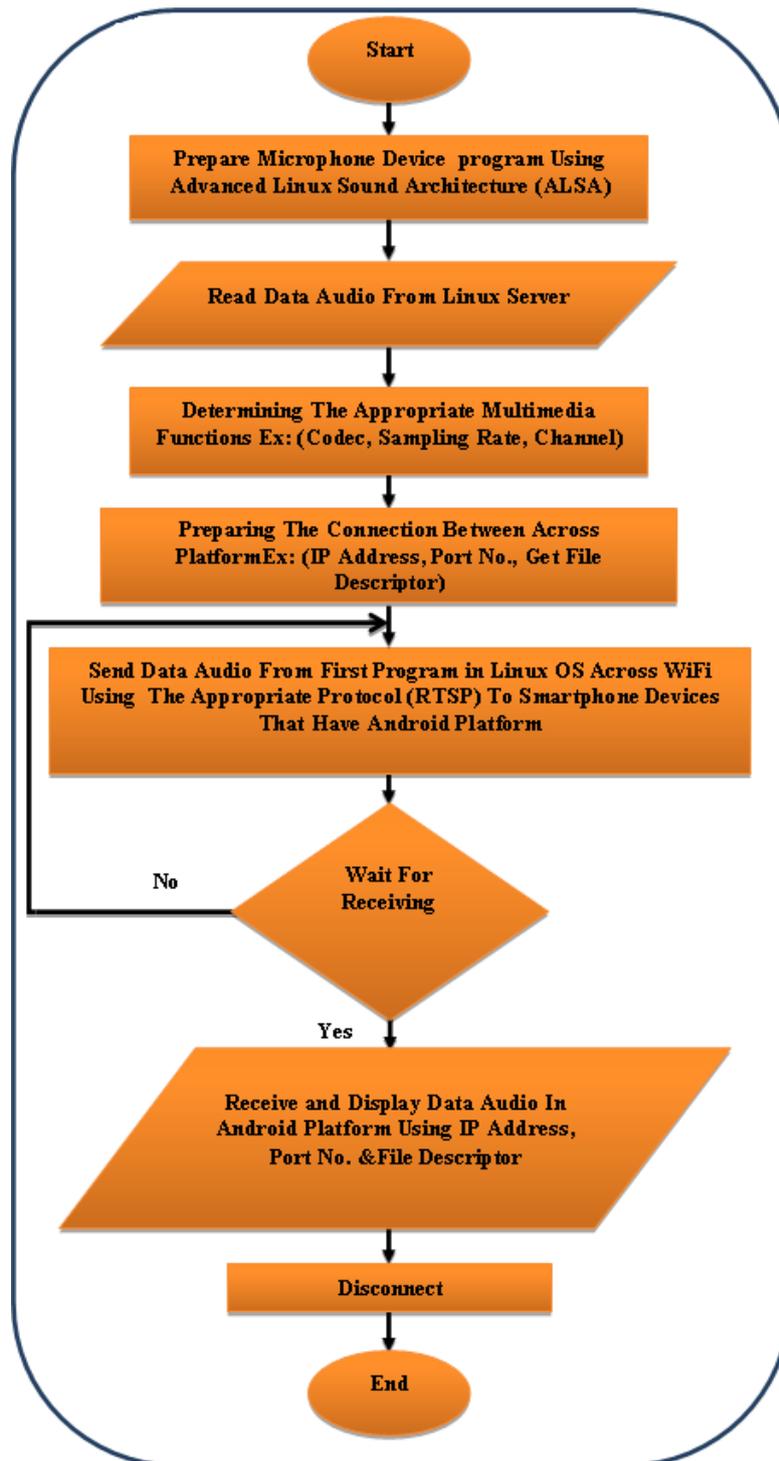


Figure (4). Streamline Progress of the Transmitter and Receiver System

7.1 First Program

Get main packages building the required starting from the installation program (VLC Player) on the operation system (Linux Mint distribution).

After installation of packages and libraries important and special the completion of environmental development and for supporting multimedia extension (.deb) The package (*ffmpeg*) which is one type of packages and libraries which is a computer

program that can record and turns and broadcasts and sounds numeric in multiple formats.

Also the library (live555) is used which represents the Library flow (RTSP) for multimedia. It is a set of (C++) libraries for multimedia streaming, using open standard protocols (RTP/RTCP, RTSP and SIP). These libraries can be used to build streaming applications, receiving, and processing (MPEG), (H.263 +) or (JPEG) for video, and a number of codecs for audio files, and can easily be extended to support additional codecs. It can also be used to build (RTSP) or (SIP) for clients and servers.

Select Multimedia Properties that will deal with the (device), which represents the microphone which is located in the (/dev/dsp) files, special files will not create because this will waste time in the formation of the file and reading, it will capture data directly from the device and then passes it.

The configure file that contains a stream audio has set of characteristics as follows:

- Audio codec used is mp4a.
- Sample rate value is 44100 sample per second.
- Channel value is 2 which means sound is stereo.
- Audio bitrate value is 128 bits per second.

7.2 Second Program

A program using (Java Android) language used to receive voice and music from the server. Using the (Eclipse) program as a medium for construction, after that creating packages necessary by the language of design programs and applications to the program Android (Eclipse). The application interface program is designed by using XML language.

8. Application Experiments

Experiment has been applied on more than one device in the communication process by using two similar devices with the same operating system, the result is receipt of the sound and voice success.

Wireless Router Device is used to establish a connection between the Server computer and group of smartphones.

Also, another experiment was applied and receipt the sound from the sender using the network type (Ad-Hoc) mechanism is available in Laptop devices without using a wirelessrouter.

9. Conclusions and Future Works

Successful communication between personal computer with Linux (Mint) operating system with smartphone device under Android operating system has been achieved with good period of delay between the transmission and receipt (about five seconds experimentally from the beginning of the transmitter). This means that audio can be done in spite of using devices having heterogeneous operating system. Future work is to design and implement streaming on video files by using DVB-H (Digital Video Broadcasting Handheld).

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