Development of the Graphical User Interface of Mobile Application for Remote Control of Digital Audio System

Jung-Sook Kim[1] , Junho Jeong[2] , Euldong Kim[2], Jinok Park[2], Sunhang Lee[2]

[1] Department of Smart Contents, Kimpo University,
[2]Department of Computer Engineering, Dongguk University
97, Gimpodaehak-ro, Wolgot-myun, Gimpo-si, Geyonggi-do, Korea
kimjs@kimpo.ac.kr

Abstract. In this paper, we developed a graphical user interface of mobile application to control a digital audio system remotely. Especially, the mobile application must control many channels simultaneous. The number of input channel is 4 and the number of output is 8. Also, it has a lot of graphical components and has many components that are controlled by the mobile application. As that result, an efficient memory management is necessary in order to execute the operation and hard cording is needed on the mobile application. To solve that problem, a GridLayout is used. As that result, the screen size is not problem to operate the mobile application on android.

Keywords: Graphical User Interface, Band Pass Filter, Equalization, Digital Audio System, Mobile Application, Remote Control, Graphic Equalizer

1 Introduction

A user interface, also called a "UI" or simply an "interface," is the means in which a person controls a software application or hardware device. A good user interface provides a user-friendly experience, allowing the user to interact with the software or hardware in a natural and intuitive way. Generally, the goal of user interface design is to produce a user interface which makes it easy, efficient, and enjoyable to operate a machine in the way which produces the desired result. This generally means that the operator needs to provide minimal input to achieve the desired output, and also that the machine minimizes undesired outputs to the human. User interface design or user interface engineering is the design of user interfaces for machines and software, such as computers, home appliances, mobile devices, and other electronic devices, with the focus on maximizing the user experience. The goal of user interface design is to make the user's interaction as simple and efficient as possible, in terms of accomplishing user goals (user-centered design)[1]. Digital audio is technology that can be used to record, store, generate, manipulate, and reproduce sound using audio signals encoded in digital form. Following significant advances in digital audio technology during the 1970s, it rapidly replaced analog audio technology in most areas of sound production, sound engineering and telecommunications. A microphone converts sound to an analog electrical signal, then an analog-to-digital converter (ADC)—typically using

pulse-code modulation—converts the analog signal into a digital signal. The amplitude passed by each filter is adjusted using a slide control to boost or cut frequency components passed by that filter. The vertical position of each slider thus indicates the gain applied at that frequency band, so that the knobs resemble a graph of the equalizer's response plotted versus frequency. Room acoustics describes how sound behaves in an enclosed space. The sound wave has reflections at the walls, floor and ceiling of the room. The incident wave then has interference with the reflected one. This action creates standing waves that generate nodes and high pressure zones. After determining the best dimensions of the room, using the modal density criteria, the next step is to find the correct reverberation time. The most appropriate reverberation time depends on the use of the room. Times about 1.5 to 2 seconds are needed for opera theaters and concert halls. For broadcasting and recording studios and conference rooms, values under one second are frequently used. The recommended reverberation time is always a function of the volume of the room. Several authors give their recommendations [2-5]. As a result, a digital audio system is developing by many manufacturers for sale. But, the price of digital audio system is very expensive and the cheap product is necessary. And the audio systems must be controlled by the kinds of concert for the best sound quality. As that result, the user needs the remote control in order to play the audio system according to the kinds of concert in opera theater and concert halls efficiently in real-time. And we developed the remote control method which is a mobile application on android. However, the mobile devices have a small screen and have various the number of pixel. In order to develop the mobile application, the designer must consider the application features, event handling method, screen size, and etc deeply. Especially, our system must be control many speaker units of digital audio system, which has 4 input channels and has 8 output channel, using a mobile application simultaneous. In this paper, we design and developed the graphical user interface to remote control of digital audio system efficiently.

The organization of this paper is as follows. Section 2 describes a graphical user interface of digital audio system with remote control on android. Finally, conclusions and future research presented in Section 3.

2   User interface of Mobile Application

A digital audio system is composed of two parts. The one is hardware and the other is software part. The hardware system has the functions; 1) input: 4 channels which are the analog inputs and 4 channels which are the digital inputs using AES/EBU simultaneous; 2) output: 8 channels according to setting value of a DSP. The software has the functions; 1) sound processing: Cross-over, EQ (Equalizer), Delay, and Limiter; 2) applications for controlling the digital audio system.

We are implementing the digital audio system using java language on the android environment. And we used the TCP/IP socket interface in order to connect client and server for remote control. In sound recording and reproduction, equalization is the process commonly used to alter the frequency response of an audio system using linear filters. Most hi-fi equipment uses relatively simple filters to make bass and treble

adjustments. In the mobile application, each GEQ (Graphic EQualizer) Vertical Seek Bar is used. It has the frequency range value from -15.0 to 15.0 and the frequency range value is divided in units of 0.5 such as -15.0, -14.5, -14.0 …. 14.0, 14.5, and 15. And the 31Vertical Seek Bars are used for controlling each frequency range of volume. In the mobile application, imageView class is used for representing the circles on a screen and onTouchListener is used for finding the axis of an ID that is an audio system. And setOnseekBarChanged is used for getting the changed value of seekBar which is implemented using a VerticalSeekBar class. Also they are represented by graphic user interface for easy operation of user. A user interface, also called a "UI" or simply an "interface," is the means in which a person controls a software application or hardware device. A good user interface provides a user-friendly experience, allowing the user to interact with the software or hardware in a natural and intuitive way. And we developed the remote control method which is a mobile application on android. However, the mobile devices have a small screen and have various the number of pixel. In order to develop the mobile application, the designer must consider the application features, event handling method, screen size, and etc deeply. Especially, our system must be control many speaker units of digital audio system, which has 4 input channels and has 8 output channels, using a mobile application simultaneous. Also, it has a lot of graphical components and has many components that are controlled by the mobile application. As that result, an efficient memory management is necessary in order to execute the operation on the mobile application and hard cording is needed. To solve that problem, a GridLayout is used. The GridLayout provides a scroll function automatically, a touch event handling and an efficient memory management. And the cell size of view in the GridLayout is generated by hard coding. As that result, the screen size is not problem to operate the mobile application on android. The following figure 1 shows the result of graphical user interface on the android.

Fig. 1. Graphical user interface on android

The following figure 2 shows the input graphical user interface for remote control using the mobile application on android.
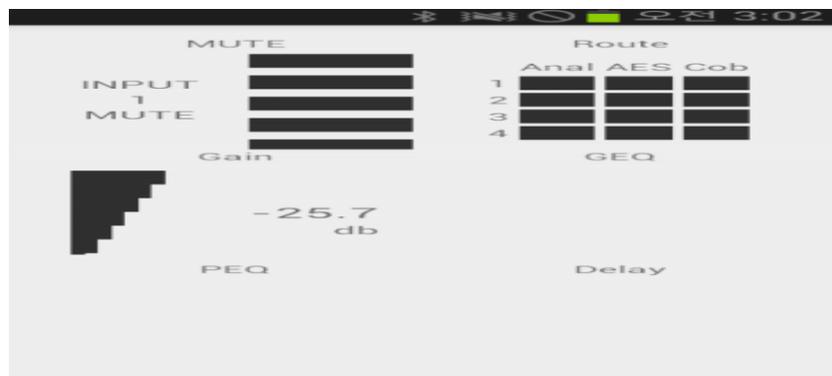
Fig. 2. Remote control using a mobile application

3   Conclusions and Future research

In this paper, we developed a graphical user interface of mobile application to control a digital audio system remotely. Especially, the mobile application must control many channels simultaneous. The number of input channel is 4 and the number of output is 8. Also, it has a lot of graphical components and has many components that are controlled by the mobile application. As that result, an efficient memory management is necessary in order to execute the operation on the mobile application and hard cording is needed. To solve that problem, a GridLayout is used. The GridLayout provides a scroll function automatically, a touch event handling and an efficient memory management. And the cell size of view in the GridLayout is generated by hard coding. As that result, the screen size is not problem to operate the mobile application on android. In the future, we will implement the digital audio system functions for sale.

References

1. http://en.wikipedia.org/wiki/User Interface.
2. http://en.wikipedia.org/wiki/Digital_audio.
3. https://ccrma.stanford.edu/courses/192b/Digital_Audio_Systems.pdf.
4. http://en.wikipedia.org/wiki/Band-pass_filter.
5. http://en.wikipedia.org/wiki/Equalization_(audio).