作品名稱

我的 Mixer 會講話
My MIXER can speak

隊伍名稱

對不起，本獎項從缺。
Sorry, This Award Is Vacancy

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作品摘要

系統介紹

為提高使用混音器的操作方便性，本作品提出以 APP 為媒介的智慧混音平台設計，如圖 1 所示。本作品能提供以語音及觸控面板控制數位混音器來達成的開關音源輸入、音量調整、等化以及殘響等效果。語音辨識部分引用 Google/Android 提供的函式庫—SpeechRecognizer 將語音轉字串後，再進行切割、比對處理，最後有效信息提出。不論是以觸控面板或是語音控制，皆會將調整後控制的參數內容以自定義藍牙封包格式封裝，此封包格式內容除了主要的控制碼以外，還加入封包頭、封包尾、封包長度、CRC（使用 CRC16–CCITT）確保傳輸準確性及資料完整性，以及 Ack 機制確認封包傳輸狀況。封裝完畢後，再以藍牙 5.0 傳給 Data Transfer Controller，確認資料無誤後，會以 I^{2}C 先將暫存器位址傳給 DSP，先指定欲更改的暫存器，再將值覆寫上去。相較於傳統設計，一般混音器使用時須以手動調整混音器的旋鈕，使用本作品能提升便利性，並且使操作更加直觀，讓專業調音師更快速掌握環境音場效果，提升樂手與聽眾在表演時的感覺。

設計動機

混音器是一種調整各種音頻訊號的設備，先修改輸入訊號的各個頻率與振幅，再將修整完的波形疊加並輸出新的音訊。相較於傳統類比混音器，數位混音器能同時混入多種效果、高噪音抵抗力、且體積較小，但操作較複雜。因此本作品提出以語音控制數位混音器，降低數位混音器的操作難度並提升便利性。目前遠程控制混音器的設計僅能調整殘響效果及音量，而本作品提出的平台除了各個輸入訊號的增益，還能分別調整等化器的低、中、高頻的響應，以及調整殘響程度。在音樂表演的場合中，會需要包含混音器、喇叭等的擴音系統（Public address system，PA system），其調整複雜，

通常都會由專業的 PA （Public address，調音師）負責調整，但因為調整對象不同，因此會有不一樣的調整需求。調整時往往需要 PA 在現場聆聽表演者演出後，再即時進行調整。實際上，因為需要不斷的測試與調整才能達到最佳效果，造成整個過程不但耗時，且不方便。

於演出現場混音時，可能為了減少於現場及後台之間的來回時間，會以合作方式，一名 PA 於舞台聆聽效果後，給予後台 PA 調整參數，但這個方法容易因為樂手敘述及理解的不同，調整混音器時會有所誤差。本開發平台提供遠端音頻控制，能將 APP 與混音器以藍牙連線，PA 故而能於舞台前隨意走動進行測試，測試後可及時調整須更改參數，使演出效果達到最佳。
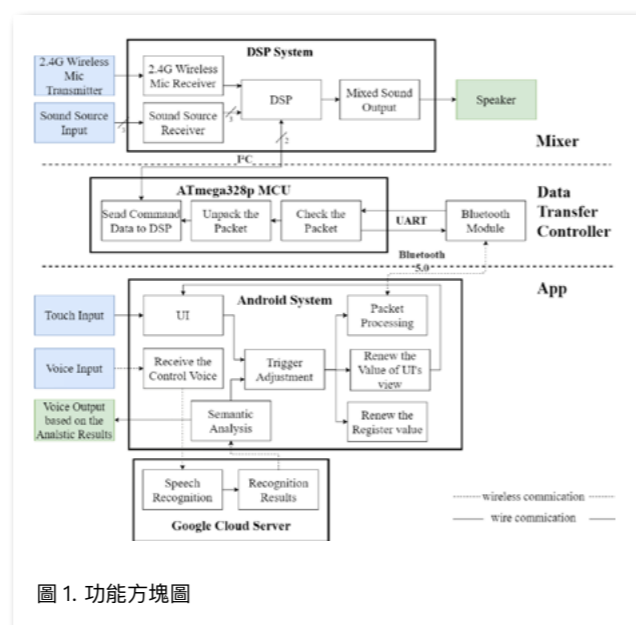

圖 1. 功能方塊圖

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Abstract

System introduction

This work presents an intelligent system platform design for hybrid mixer and digital equalizer using speech recognition technology instead of manual turning the knobs. The proposed platform provides both touch control and voice control for adjusting sound sources, volume, and the effects of equalization and reverberation using a smartphone APP. For speech recognition, a Google cloud service releases a strong function library, i.e. "SpeechRecongnizer class", which helps convert short time speech into a string. Then, a useful control message extracted from a string segmentation and comparison processing is transmitted to a Data Transfer Controller (DTC) by a Bluetooth module. To connect the smartphone and the proposed DTC, we especially define a self-defined Bluetooth Packet Format (SBPF) into the Bluetooth5.0 protocol. The proposed SBPF also adopts Cyclic Redundancy Check (CRC, CRC-16-CCITT), and acknowledgment mechanism to improve the transmission correctness and data integrity. For the proposed hybrid mixer and digital equalizer, a Digital Signal Processor (DSP) is employed to be the kernel of this intelligent system platform and is connected to the proposed DTC by I^{2}C protocol. Compared to traditional audio mixer designs, a man who is responsible for public address system (PA) can more quickly predominate the effects of the ambient sound field by using voice/touch control via the proposed APP, and enhances listeners' feelings about live band performance.

Design motivation

A powerful sound mixer is an electronic device for combining and adjusting sounds of many different audio signals. It not only modifies the frequency and amplitude of the input signal but also integrates the trimmed waveform to output new audio. Compared with traditional analog mixers, digital mixers can mix a variety of effects at the same time. It has the following advantages in terms of cleaner sound quality, higher signal-to-noise ratio (SNR) noise suppression, and smaller device volume, but more complicated operation. In general, an audio engineer, who is responsible for public address (PA) system, must satisfy and deal with all requests from vocal, musicians, and listeners in a live band performance. While different instruments are used, performers will have different and individual adjustment needs. It is often necessary for the PA to listen to the performer's performance on the spot and then makes adjustments immediately. This is not easy for

an inexperienced person to control every detailed operations and sound effects. Also, it is still a hard work for an experienced audio engineer to remote control a mixer console and makes the sound field of the entire performance environment become more shocking and more feeling. Therefore, some approaches proposed a flexible way to use manual adjustment and control on an audio mixer, to reduce the difficulty of the mixer operation, and to improve its inconvenience. The proposed development platform provides remote audio control and speech recognition, which can connect the APP and the mixer via Bluetooth, so the PA can walk around in front of the stage for testing. After the test, PA can adjust and change the parameters in time to achieve the best performance.
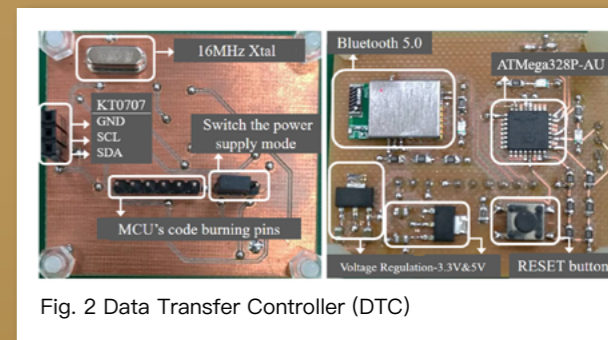
Fig. 2 Data Transfer Controller (DTC)