



Namal University, Mianwali

Department of Electrical Engineering

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Lab Project

***Smart GUI-Based Audio Mixer with Real-Time
Voice Integration***

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Smart GUI-Based Audio Mixer with Real-Time Voice Integration

1. Abstract

In this project, the formulation of a smart graphical user interface (GUI) based audio mixer application which has the capacity of incorporating a real-time voice input is provided. This application was created in MATLAB and will enable the mixing of preloaded audio clips with in real life voice inputs, manipulation of the volume of each input, total volume control and visualizing of the input and the mixed audio. The project is an integration of concepts of digital signal processing (DSP), graphical user interface (GUI) programming, and interactivity to form a marketable and instructional audio device.

2. Introduction

Audio mixing is an important process of the modern multimedia application that results in enriching user experiences. Although there are professional digital audio workstations on the market, most are advanced and beyond reach to the inexperienced. This project fills this gap and gives an easy but efficient and effective tool to combine various audio tracks with the user-friendly GUI. This integration of real-time voice recording integration is the specialty of the system and it enables the system to be used in basic podcasting, audio projects, as well as educational use.

3. Objectives

- ✓ To develop a GUI of MATLAB audio mixing.
- ✓ In order to add the feature of using real-time voice recording.
- ✓ Enables the control of volume of every audio playback containing live voice.
- ✓ To visualize the wave form to help in better analysis of the audio.
- ✓ In order to export the mixed audio to a.wav file.

4. Tools / Application

- MATLAB R2023 and above
- MATLAB Graphical interface(uicontrol, uipanel, subplot)
- Audio functions in MATLAB (audiorecorder, audioplayer, audiowrite)
- Sound files (in MATLAB, e.g., train, chirp, gong, etc.) that are preloaded into MATLAB (meaning that they do not have to be loaded, just called)

5. System Design and Technique

Design of User interface:

A controls and visualization panel with a fixed-size GUI window. Audio sliders are made by use of MATLAB GUI elements, text labels, buttons, and dynamic waveform plot.

Audio Sources:

6 ready to use .mat files of audio files (train, chirp, gong, splat, handel, laughter) and 1 real time input voice.

Recording Mechanism:

A user can put in the recording time and record voice by making use of MATLAB audiorecorder. Data recorded is stored and normalized to be mixed.

Volume Control:

There is a volume slider to the individual audio tracks which take the range 0 to 1. All-over volume can be manipulated with the help of a master slider.

Audio mixing reasoning:

Any chosen and volume normalized sounds are brought in sample by sample. The combined output is normalized and attenuated by the master volume.

Visualization:

Input signal and mixed output waveform are displayed in two subplots in real-time.

Output Handling:

One can play or record the last mixed signal in the primarily accessible format of .wav using `sound()` and `audiowrite()`.

6. Features of the Application

- Clean and intuitive GUI layout.
- Supports live voice recording with adjustable duration.
- 7 independent volume sliders including live input.
- Master volume control.
- Real-time waveform plotting.
- Export of mixed audio to .wav format.
- Error checking and user feedback messages.

7. Analysis and Results

- Properly combined six audio channels and voice in real time.
- It displayed live visualization of signals.
- WAV files of high quality were exported.
- Managed the timing of the inputs and silence fallback on missing files.
- Provided non-clipped output by ensuring normality.

8. Limitations

- ✓ **Limited Functionality:** Restricted to basic mixing of predefined sounds and one recording; no external file import or advanced audio effects.
- ✓ **Low Audio Quality:** Fixed 8000 Hz sample rate results in poor fidelity.
- ✓ **Basic UI:** Static interface with minimal visualization and user feedback.

9. Conclusion

This project illustrates efficient and easy audio mixing system which has the ability to combine preloaded music or media and voice in real-time. The interface streamlines the process of audio mixing and forms a good basis towards multimedia applications in the future. This project is able to combine the ideas of DSP with using GUI based software design.

10. References

[1]MathWorks, “Matlab Documentation,” *Mathworks.com*, 2019.
<https://www.mathworks.com/help/matlab/>

[2]“Digital Signal Processing.” Available: https://www-elec.inaoep.mx/~jmram/Digital_Signal_Processing_LI_TAN.pdf