TEXAS STATE
INGRAM SCHOOL OF ENGINEERING

E2.04 – Audio Mixer & PA System

Project Overview

An audio mixer which will adjust the channel volumes of all the featured inputs into one single audio output to the portable speaker and function as a complete Public Address System.

Motivation

Currently the college rents a PA system for events such as Senior Design Day. Our project will replace the rented PA by designing a 6-channel audio mixer to connect to an existing speaker system.

Requirements

- 5 Mixer Inputs
- Mixer outputs to amplifier
- Budget $75
- Be fully characterized
- Must be portable
- Operate from 35 -20 kHz

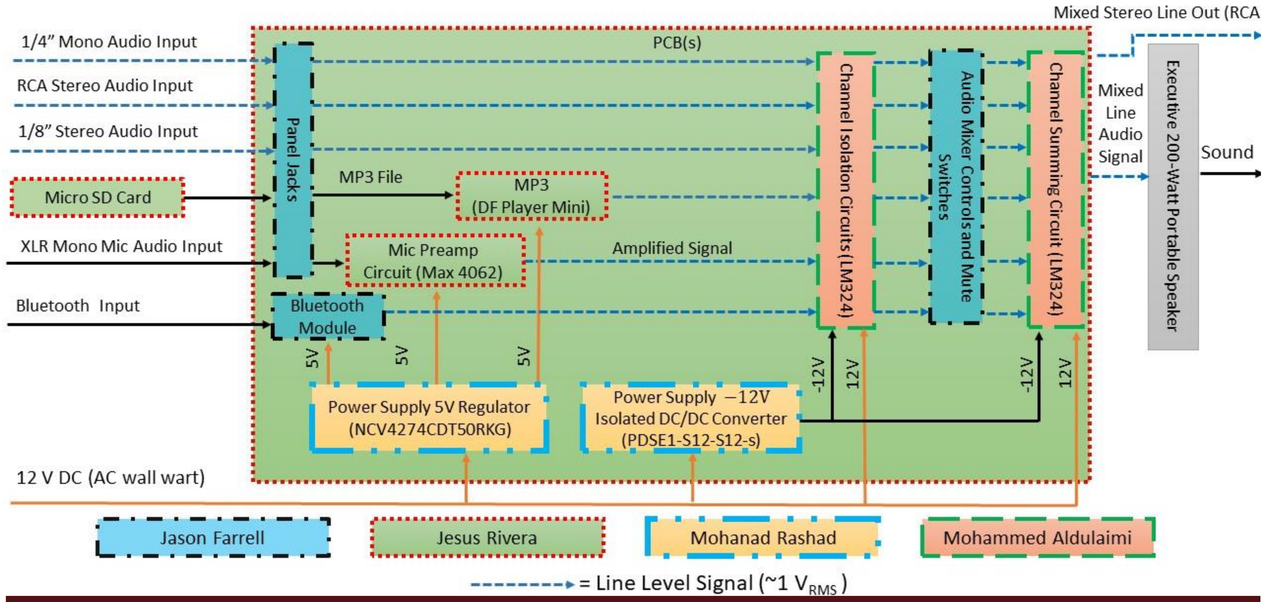
Key Features

6 Audio Channels/ Inputs

Stereo	Mono
Bluetooth	XLR
1/8”	1/4”
MP3	
RCA	

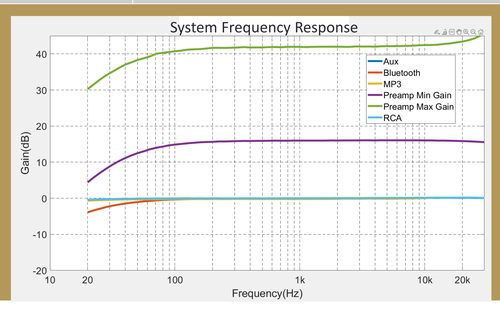
- Internal Microphone Preamp
- Stereo RCA Line out
- Channel Mute Switches
- Portability

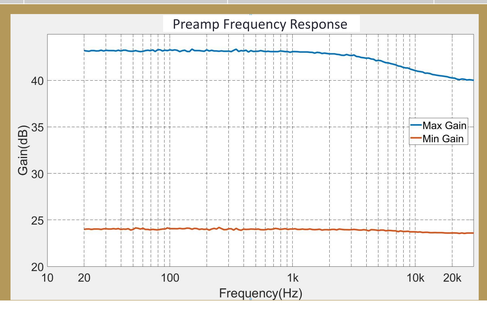
Block Diagram



Audio Mixer Characterization Results

Test	Procedure	Expected	Actual	Result
Signal to Noise Ratio	Measure and record individual channel’s noise floor, in dB, at summing circuit output. Provide line level signal to channel’s isolation input, and record noise, in dB, at summing output	> 60 dB	70.75 – 82.6 dB	Pass
Crosstalk	Provide line level signal to every channel excluding the victim channel; record the noise on victim channel, in dB, at output of the isolation circuit.	< -50 dB	(-52.5) – (-54) dB	Pass
Total Harmonic Distortion	Provide line level signal to channel being recorded, using Keysight Oscilloscope measure and record THD	≤ 5 %	3.42 – 3.58 %	Pass
Mute Switch Voltage	Provide line level signal to each individual tested channel and record its Vpp while the mute switch is disabled (signal pass) and enabled (no signal pass).	≈ 0 Vpp	0.056 – 0.07 Vpp	Pass
Frequency Response	Use Keysight Oscilloscope frequency response function to generate simulated frequencies across each individual channel; record bode plot.	Flat response from 35 – 20 kHz (± 3dB)	Flat response from 35 – 20kHz (± 3dB) [Mic min/max gain + 10dB)	Pass [Mic min/max gain Fail]





Team

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Subsystem Characterizations

Subsystem	Test	Expected	Actual
Mic Preamp	Min Gain	≤ 26 dB	24.94 dB
	Max Gain	≥ 40 dB	48 dB
	SnR	≥ 60 dB above Noise Floor	71.25 dB above Noise Floor
	Flat Frequency Response	Flat response across 35 Hz – 20 kHz (± 3dB)	Flat response across 35 Hz – 20 kHz (2.5 dB)
IAS (mp3)	Pause/Play Button	Song toggles play/pause status	Play/Pause Success
	Next Button	Next Song Plays	Skip Success
	Previous Button	Previous Song Plays	Back Success
	Repeat Button	Song Repeats	Repeat Success
Bluetooth	Pairing Reliability	Successful Pair (100%) ≤ 20ft	Successful Pair (100%) <= 50ft
	Connected Range	Remain Paired to Esinkin ≤ 20ft	Remain Paired to Esinkin <= 50ft
Isolation Circuit	Gain	≥ 1.42Vpp	1.5- 2.98Vpp
	Signal to Noise Ratio	≥ 60dB	60dB
Summing Circuit	Gain	≥ 1.42Vpp	1.53- 1.51Vpp
	Signal to Noise Ratio	≥ 60dB	60dB
	Clipping	≤ 12V	11.07V
Power	Provided Pre-Amp Power	5.0VDC at 50mA	V = 5.02V I = 7.7mA P = 38.65mW
	Provided Bluetooth Power	5.0VDC at 150mA	V = 5.02V I = 27.68mA P = 138.95mW
	Provided Internal Audio Signal (IAS) Power	5.0VDC at 141.46mA	V = 5.02V I = 31.01mA P = 155.67mW
	Provided Isolation & Summing Circuits Power	±12VDC at 35mA	V = ±12.01V I = 0.25mA P = 3mW
	Provided System Amplifier Power	12VDC	+12.0VDC
Speaker	Acoustic Decibel Output	> 90 dBC at range ≤ 10ft	96.7 dBC at 10ft

Acknowledgements

Instructor: Mr. Jeff Stevens
Project Sponsor: Mr. Mark Welker
Faculty Advisor: Dr. Rich Compeau
D1 Mentee: 1.02 HoloLens