



Bluetooth Audio Mixer

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November 5, 2015



Initial Project

- Client required mixing of multiple audio sources to a single audio output for personal use
- Our team had full control of the design
- Initial weeks spent researching feasibility and refining the scope of the project

Initial Requirements

- Accepts multiple audio inputs
- Each input has individual volume control
- Input signals are mixed to a single output signal
- Output (Master) volume control
- Current volume settings are displayed to the user
- User friendly controls

Initial Timeline

- January – Project specification
- February – Design and simulation
- March – Purchases and fabrication
- April – Assembly and testing
- May – Presentation
- September – Reflection for second build
- October – Redesign
- November – Rebuild
- December – Presentation of second build

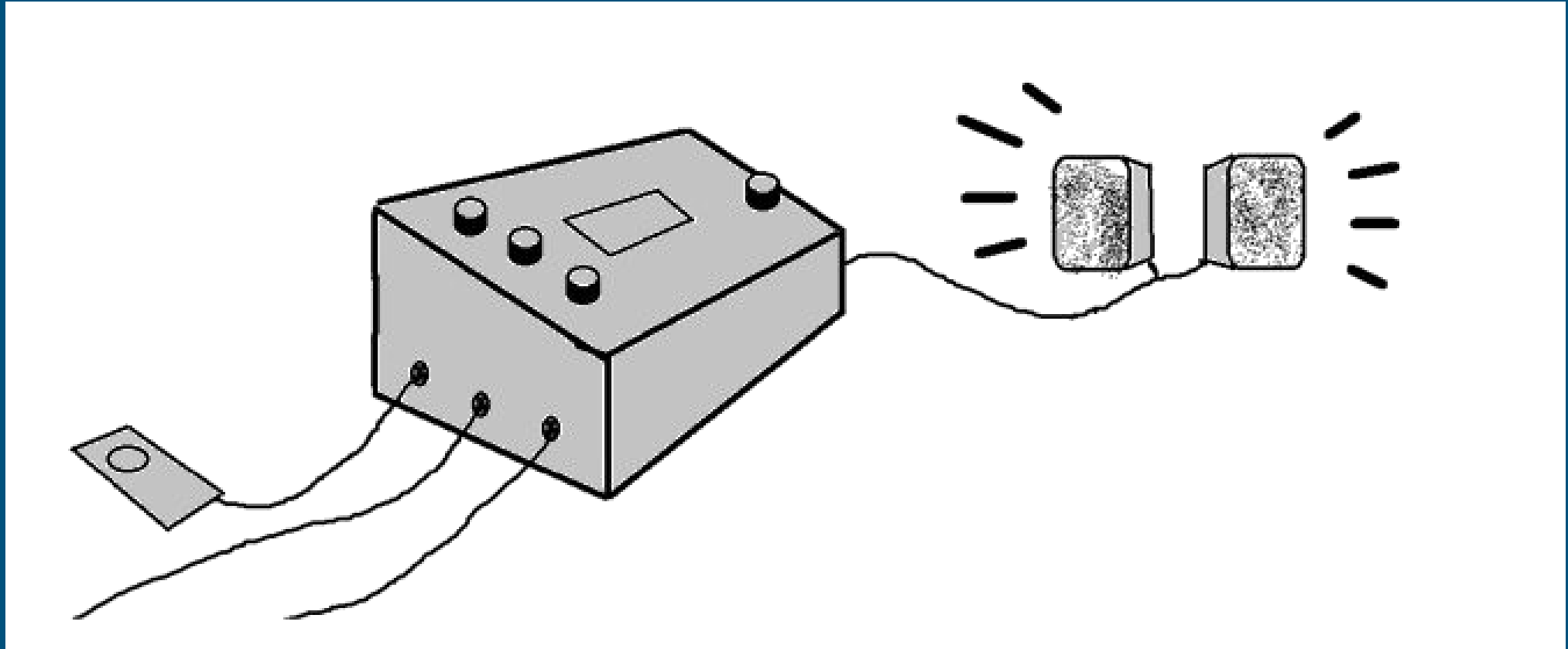
Spring Design Plan

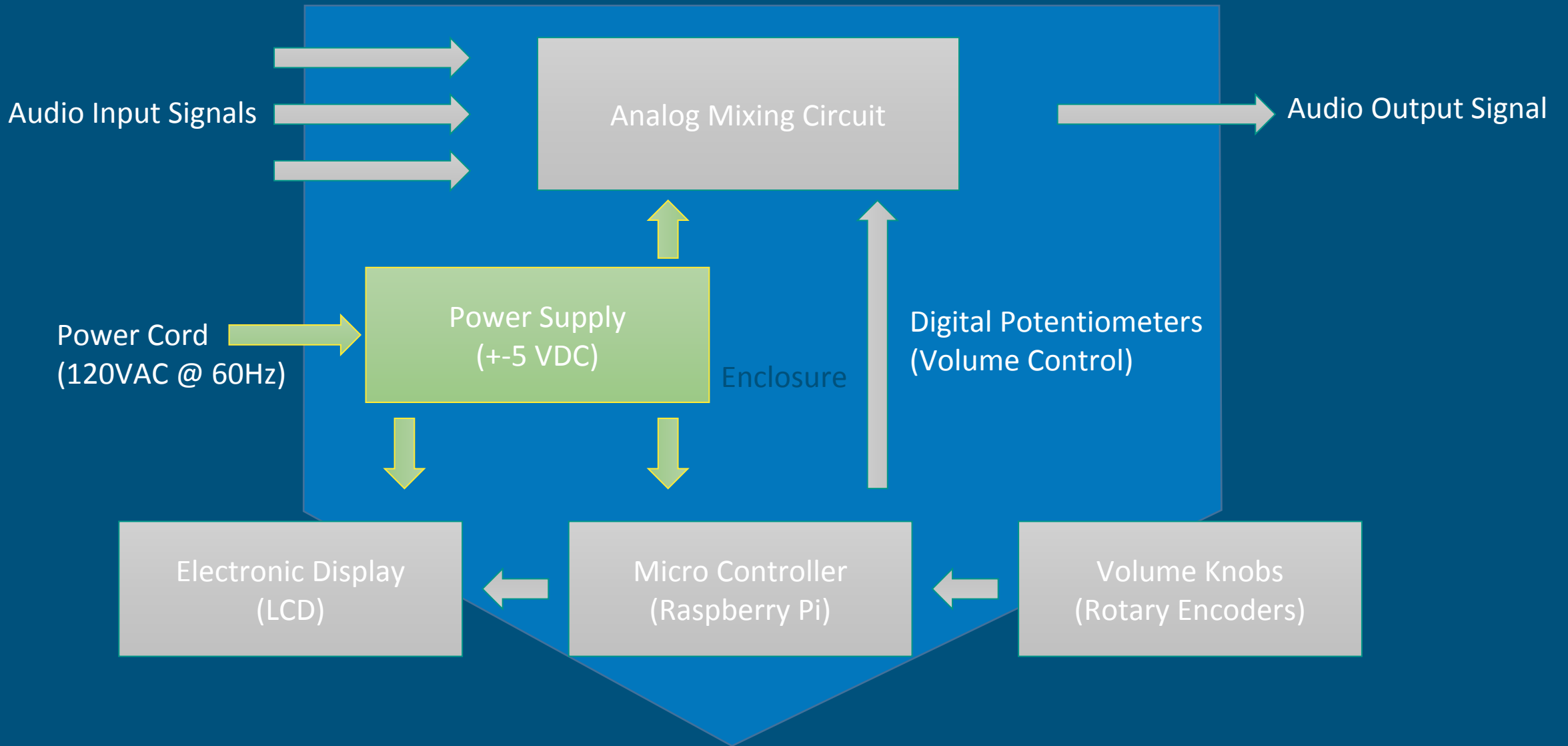
- Simple version of mixer which hit our key initial requirements
- Decoupled components
 - Planning to add additional features to the fall design
 - Upgrading of one component should not affect functionality of others
- Completion of the spring design allowed for greater risk to be taken in the fall design

Spring Mixer (Mixer 1.0)

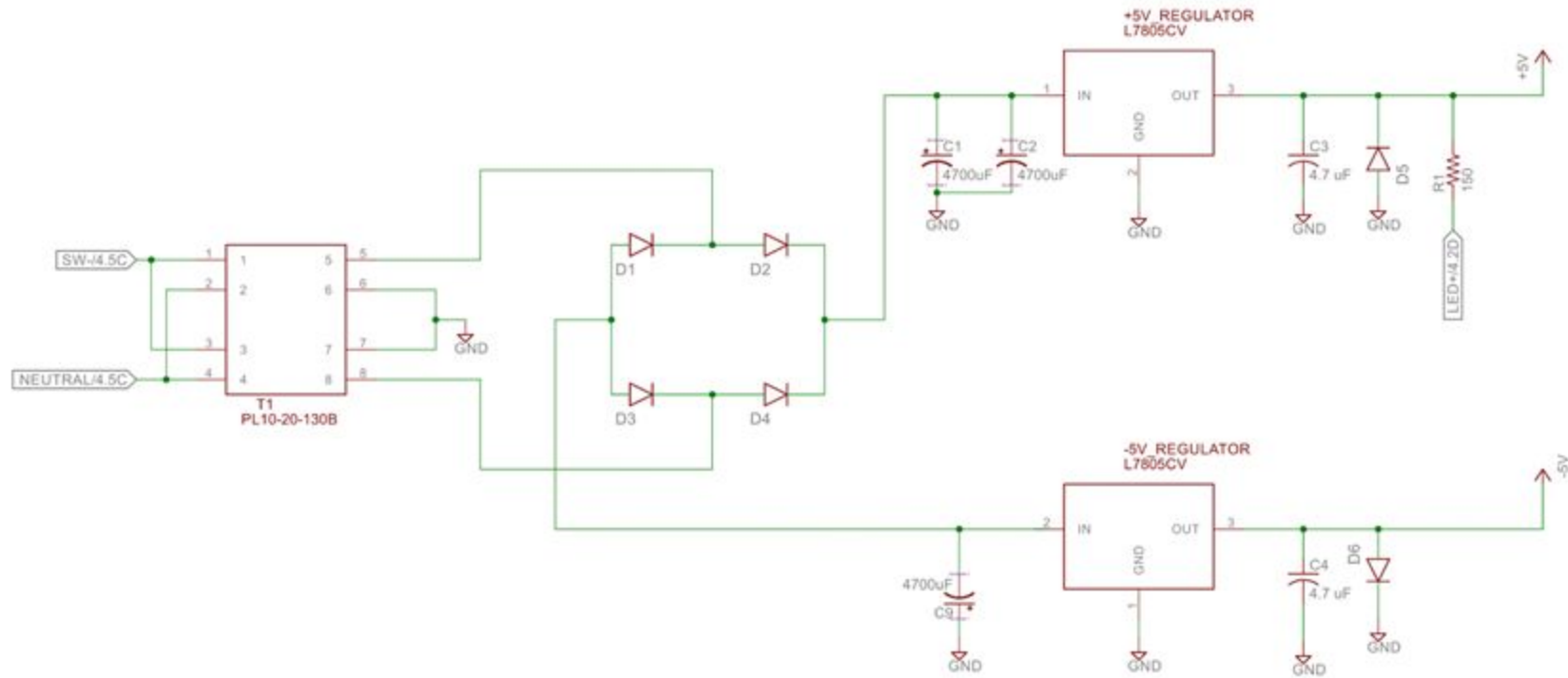
- 3 analog audio inputs on the left
- 1 analog audio output on the right
- Respective volume knobs on top for each audio channel
- Display on top of mixer show volume status of each channel

Mixer 1.0 Conceptual Sketch





Power Supply



Chad Stobbie

TITLE: Modular Audio Mixer

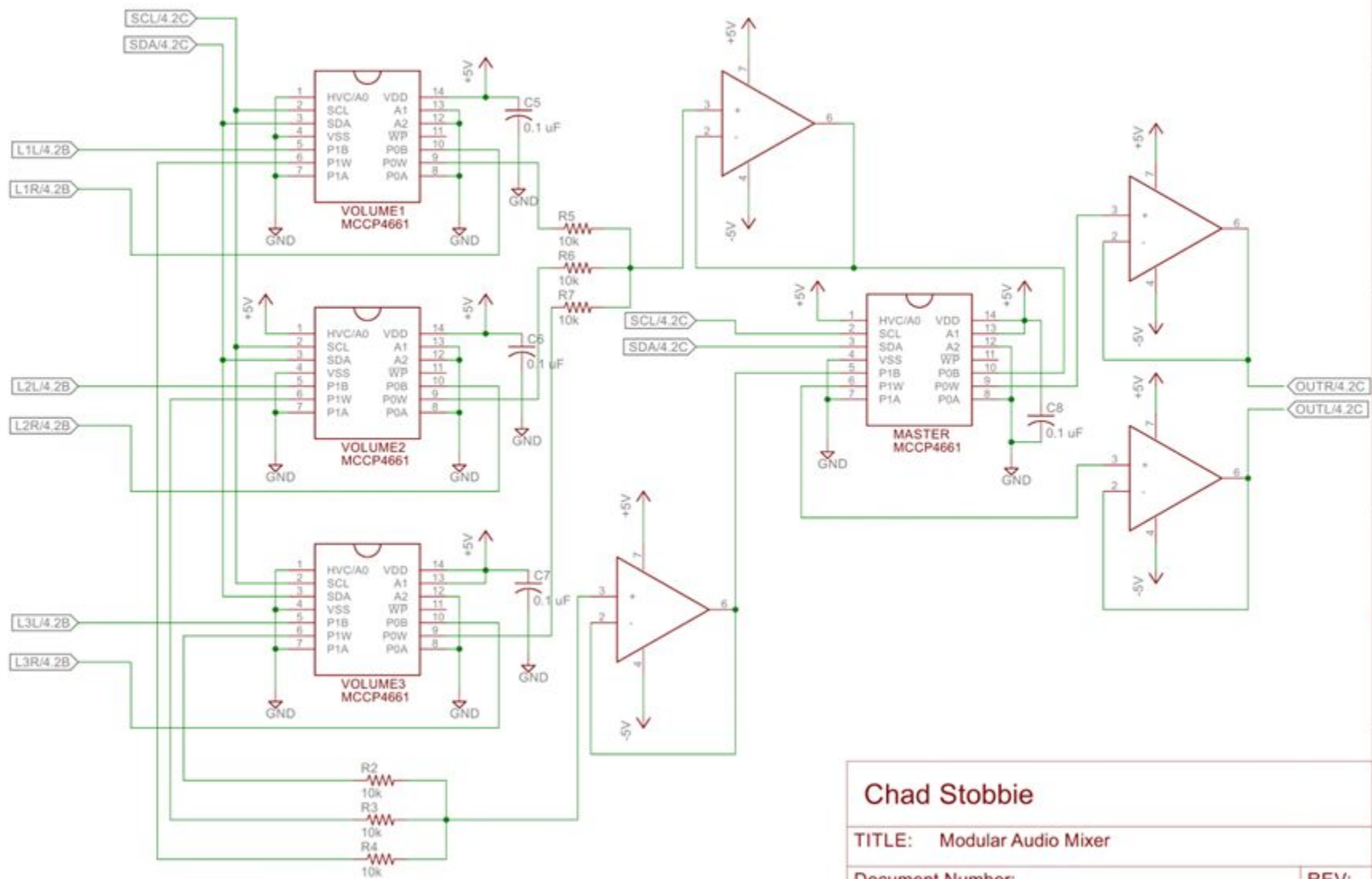
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Mixing Circuit



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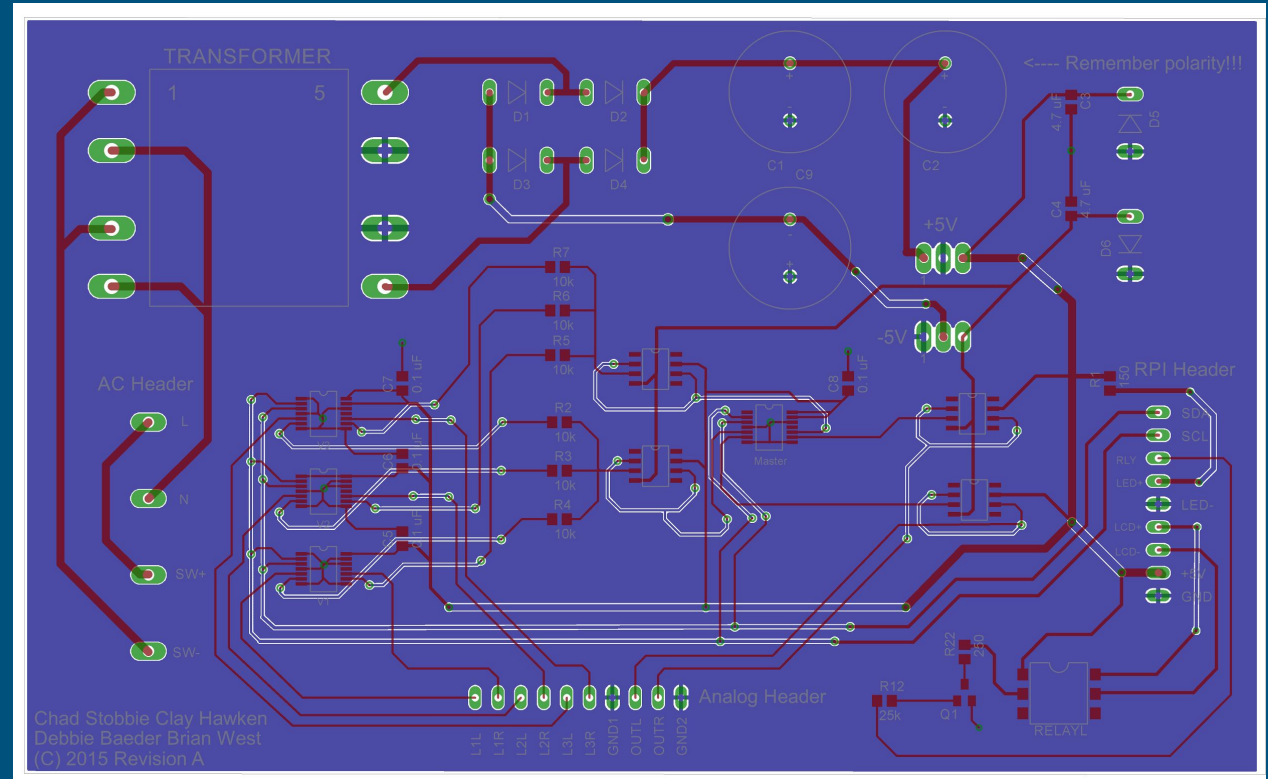
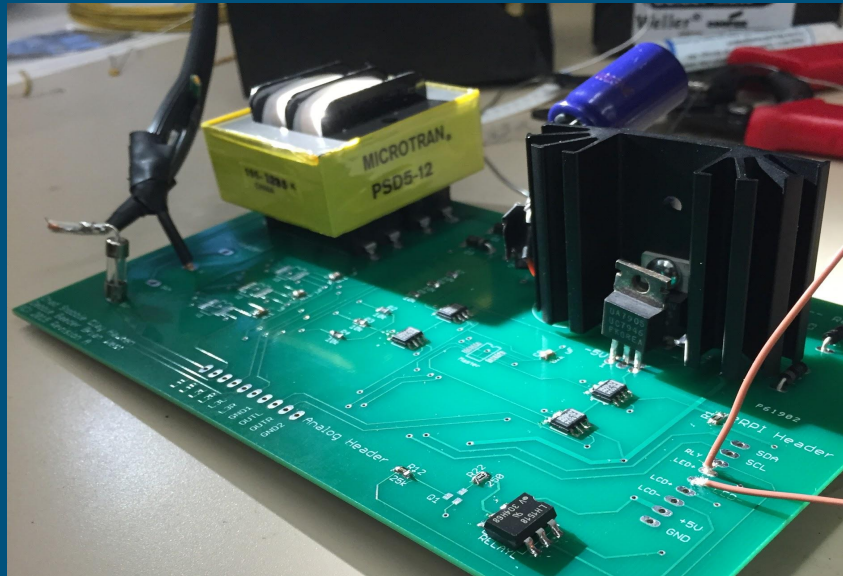
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Digital Potentiometers

- Each digital potentiometer chip contains 2 potentiometers
- Resistance between two pins varies
- Controlled by digital signal (i2c protocol) from Raspberry Pi

PCB



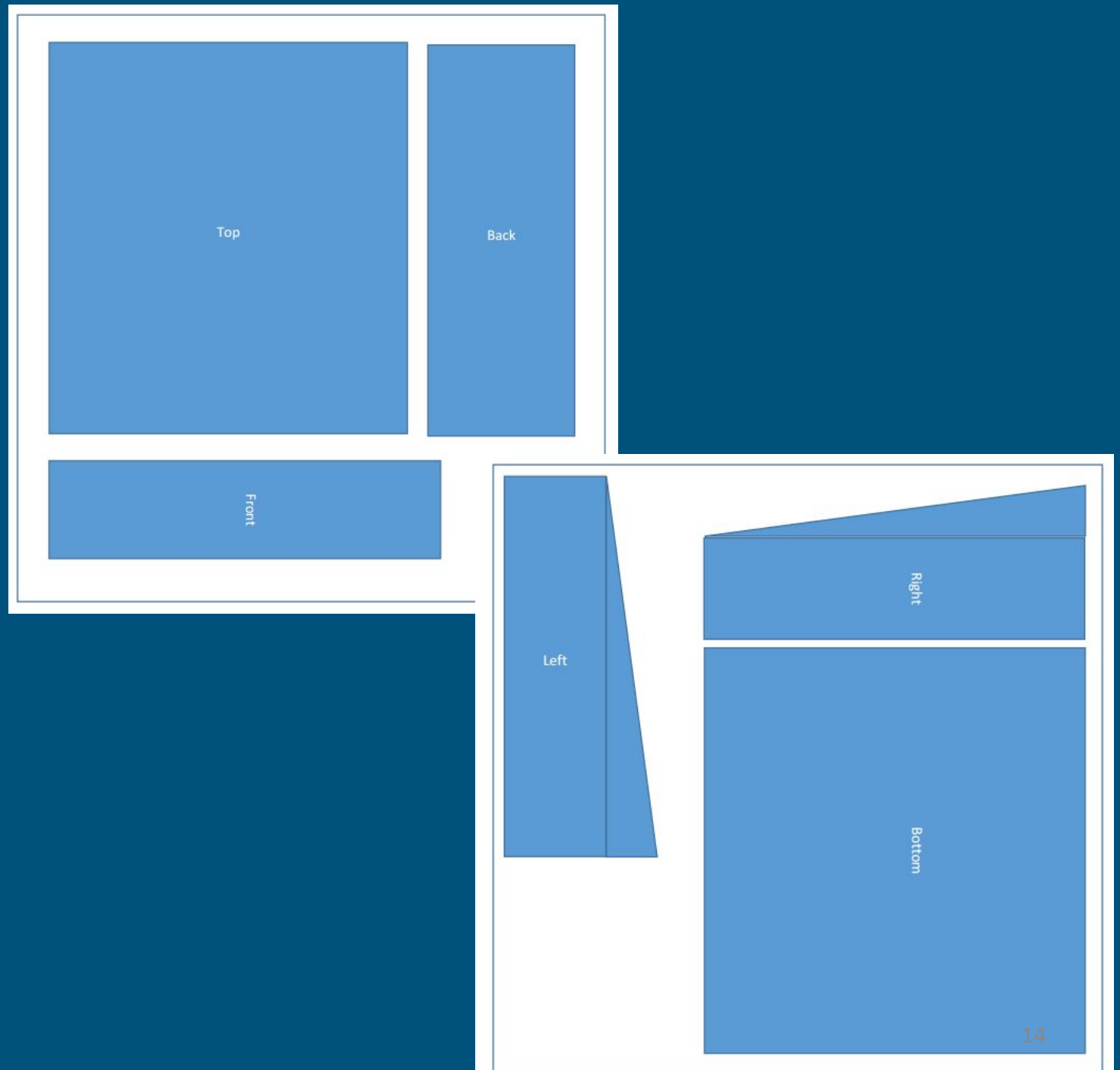
Chad Stobbie Clay Hawken
Debbie Baeder Brian West
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Raspberry Pi, Rotary Encoders, LCD

- Raspberry Pi is a small linux computer with easily accessible GPIO pins
- Overkill for initial build, but needed for advanced functionality
- Reads the input of the rotary encoders (Volume Knobs)
- Updates the digital potentiometers (volume)
- Communicates volume information to LCD

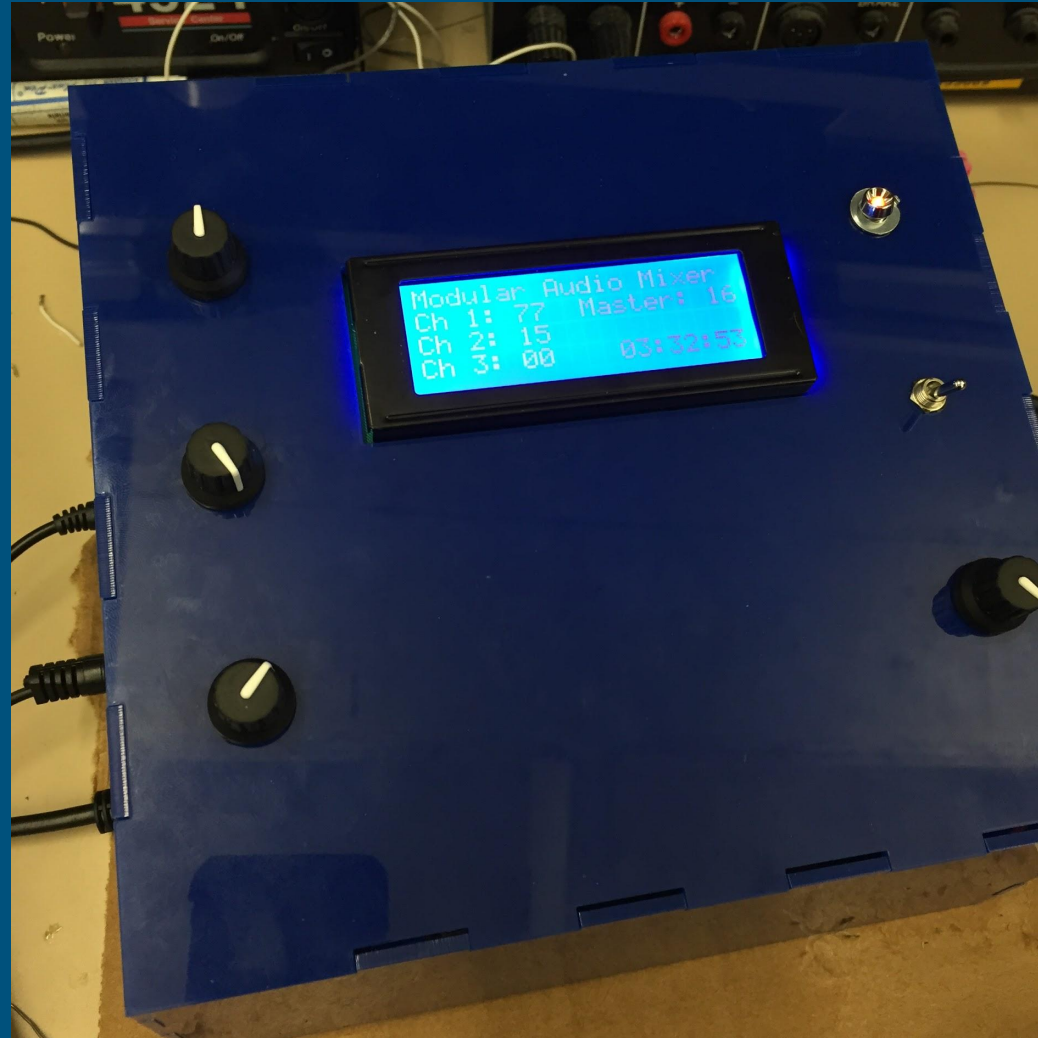
Enclosure Concept

- Stable and organized structure for support
- Facilitates user interaction
- Lightweight material



Fabrication Process

- Mechanical design in AutoDesk Inventor
- Delivered from Amazon.com
- Laser-cut in the College of Design



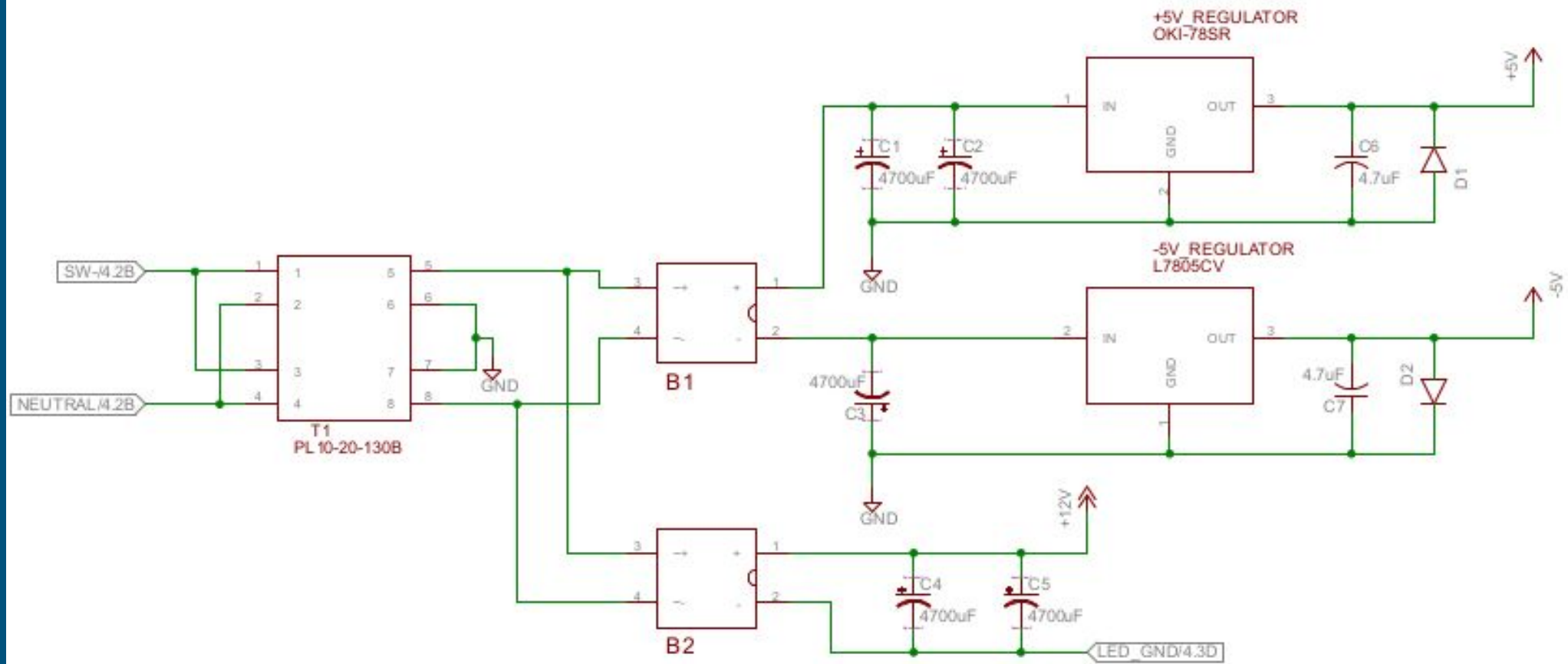
Major Issues from Mixer 1.0

- Potentiometer clipping
- Voltage regulator heatsink size
- Internal wiring was messy
- Raspberry Pi unsafely shutting down
- Enclosure component dimensions

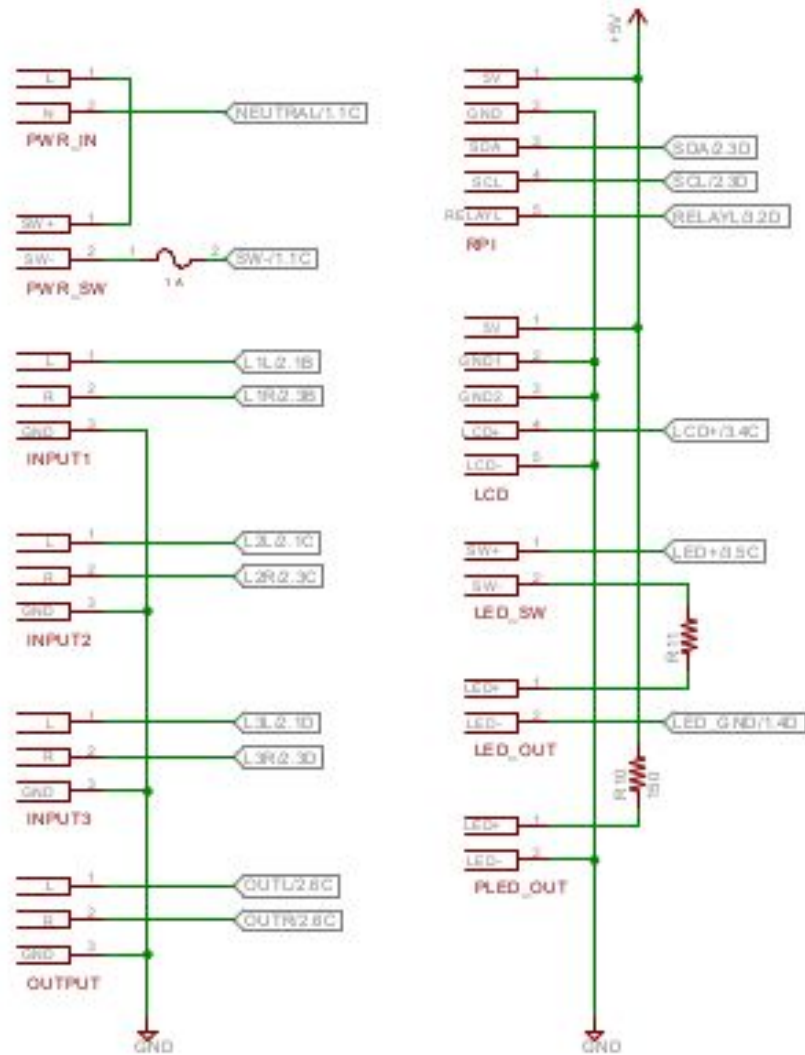
Mixer 2.0 Changes

- Wiring improvements
- Correct Digital Potentiometer
- New power supply design
- Channel 1 replaced with Bluetooth
- Raspberry Pi code improvements
- Raspberry Pi safe shutdown pack
- Enclosure and backlighting improvements

Power Supply



External Interfaces



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Raspberry Pi Programming Changes

- Bluetooth stack implementation and configuration
- Mute functionality on volume knob press
- Auto dimmer on LCD and back lighting
- Safe shutdown functionality

Enclosure - Mixer 2.0

- Same base puzzle design
- Screw reinforced LCD - removal
- Removed channel 1 audio input for bluetooth
- Dial caliper measurement for components
- Improved backlighting

Demo / User Guide - 120 seconds

- Give the Mixer power by A/C cord, switch to ON, red LED indicator
- Plug in 3.5 mm aux cord input, up to two
- Connect via Bluetooth on android and iphone
- Connect speakers to output aux port
- Adjust volume /or mute channels
- LCD displays feedback data
- Utilize master volume if needed
- Enjoy user-friendly controls

Testing

- User Interface Edge Cases
 - Remembering volume information on power cycle
 - Handling multiple volume knob adjustments at once
 - Bluetooth connectivity test
- Audio Analog Signal Chain
 - Measure distortion in audio signal
 - Frequency response
 - Total harmonic distortion