Dreamscape: A Multi-Effect Guitar Sequencer

Dec18-21

Group Members: Calyn Gimse, Derrick Lawrence, Tyler McAnally, Charles Rigsby, Karla Beas
Adviser/Client: Randall L. Geiger

Problem Statement

- Create a device that allows multiple effect pedals to be sequenced on one board
- Allow for easy configuration of effects in series or in parallel with other effects

Solution

- Create a pedalboard that processes instrument signals and manipulates them based on a set configuration
- Create an Android Application that allows the user to configure the presets and fine-tune the effects
- Include an interface that allows the user to switch between multiple presets in real-time

Functional Requirements

- An input signal is converted into a digital signal, and processed through a program on a microcontroller (Raspberry Pi)
- The processed signal is converted back into an analog signal and sent to a musician's equipment of choice
- The board must communicate preset information with an app using Bluetooth

Non-Functional Requirements

- Minimal time delay between input and output signal
  - Limited processing power from microcontroller will cause slight delay
- Android Application must be intuitive and user-friendly
- Modular preset design for ease of use by the user
- High input impedance and low output impedance for maximum voltage transfer to and from external equipment

Standards:

- Bluetooth communication must follow IEEE 802.15 standards
- Transformer used must follow IEC 60076 standards
- All other products used must follow respective standards

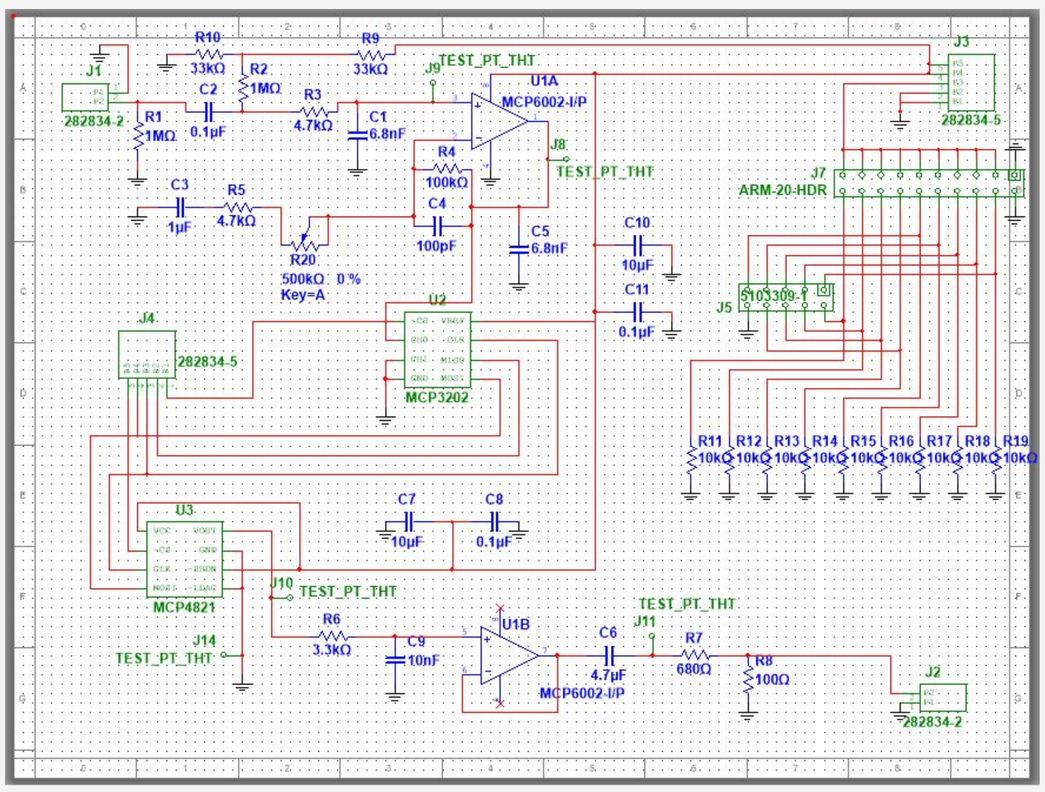
Operating Environment/Users

- Designed for live performances, either on a stage or in a private area
- Intended for casual or semi-professional musicians

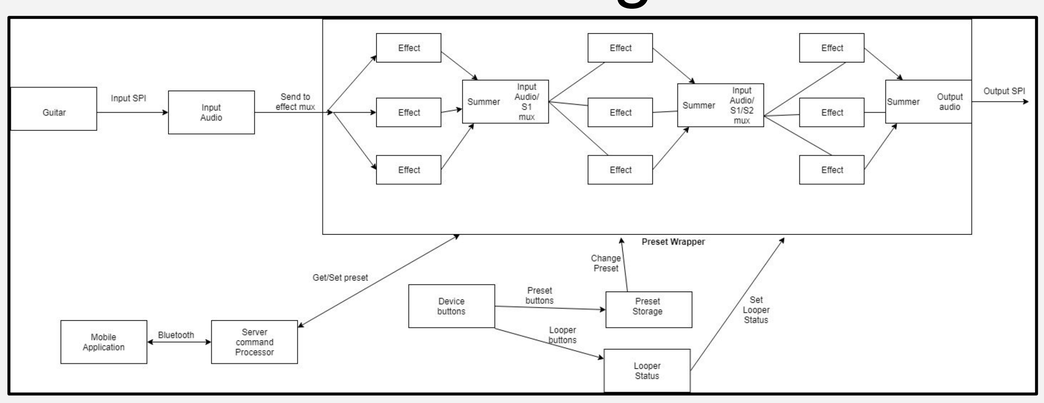
Testing

- Hardware tested with 1 kHz sine-wave to simplify testing of:
  - Reconstruction verification
  - Signal-to-Noise ratio
  - Latency of data conversion and DSP process
  - Gain of system (due to ADC/DAC reference discrepancies)
- Software and effects processing tested using arbitrary wav files with various preset configurations
- Application functionality tested using static presets to be passed to/from the mobile device

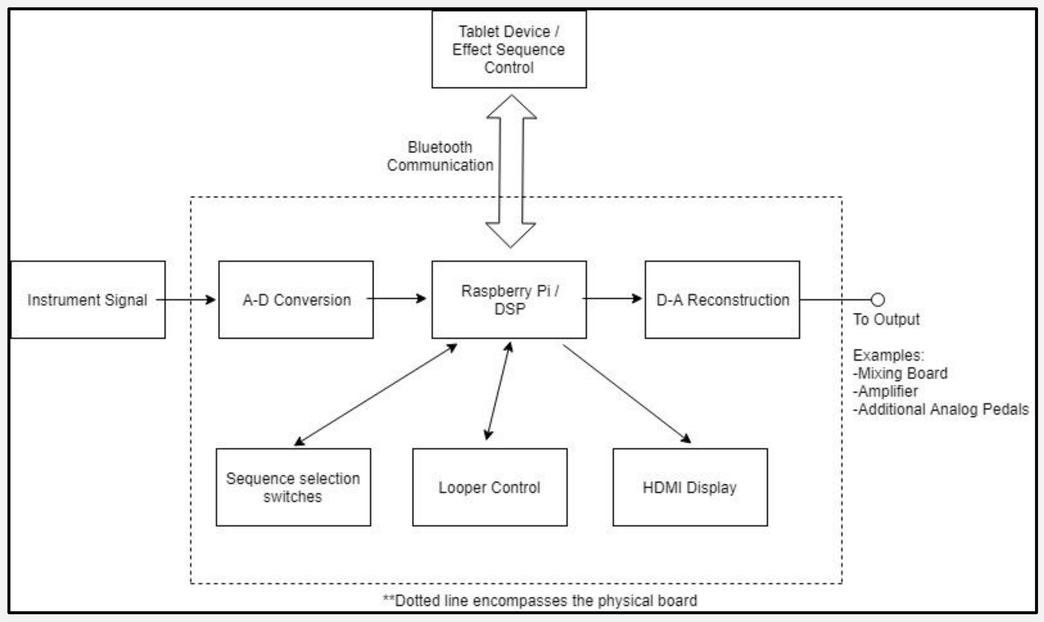
Circuit Diagram



HW/SW Diagrams

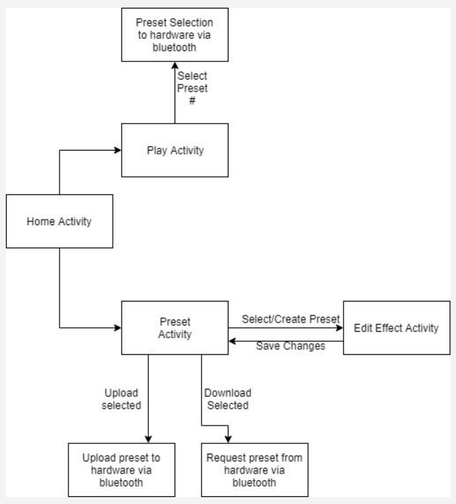


Software Diagram



Hardware Diagram

App Diagram



Available Effects

- Bitcrusher
- Booster
- Delay
- Distortion
- Echo
- Fuzz
- Loopers
  - Reverse and Forward/ Backward variants
- Octaver
- Reverb
- Tremolo