Stairway to Hamerschlag

Team D8
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Improved Guitar Pedal Design Workflow

Design Underlying Pedal Circuitry

Enter Circuit Description on Circuit Builder GUI

Stairway to Hamerschlag Workflow

Simulate against recorded / live audio and listen to circuit effects on sound
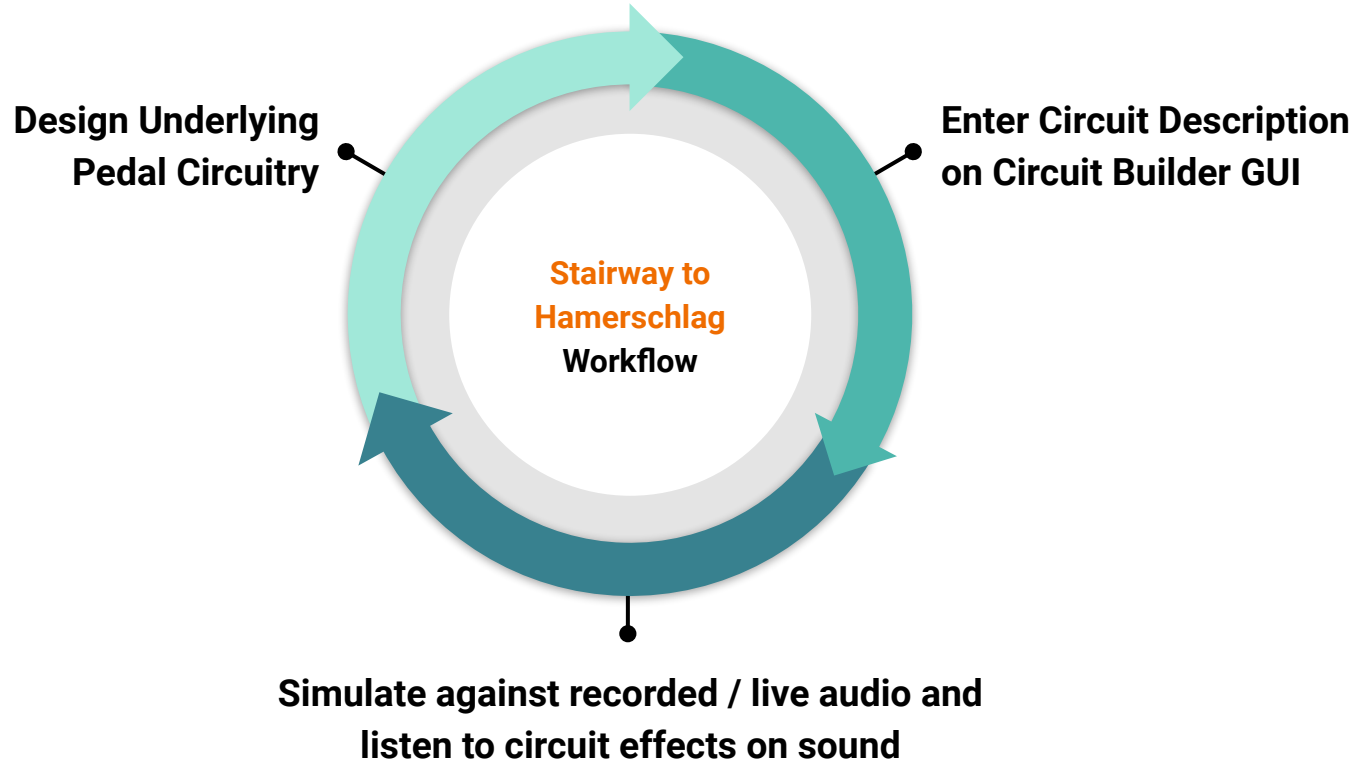
Project Breakdown

Frontend / UI
- Capture user circuit designs
- Allows users to select audio sources
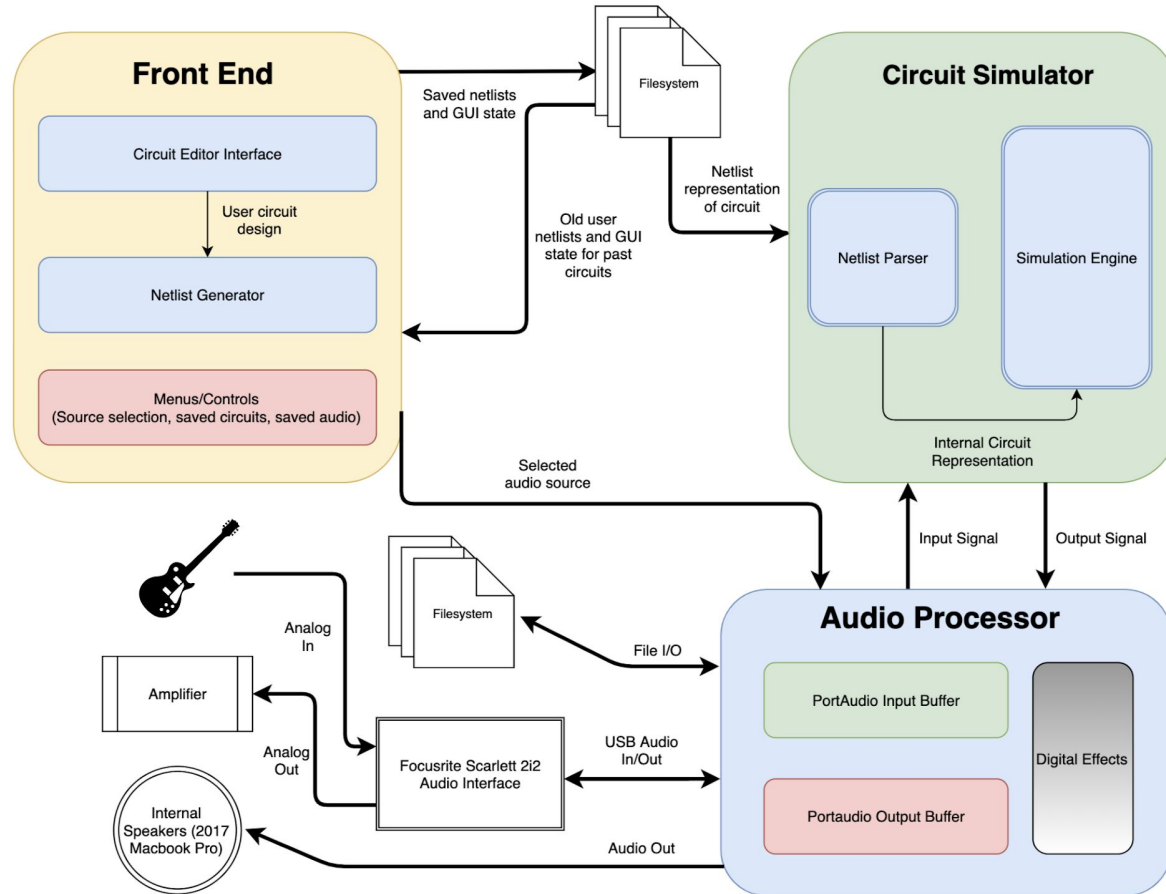- Responsible for building netlists for the simulator

Circuit Simulator
- Preprocess custom user circuits
- Perform live simulation and signal transformations
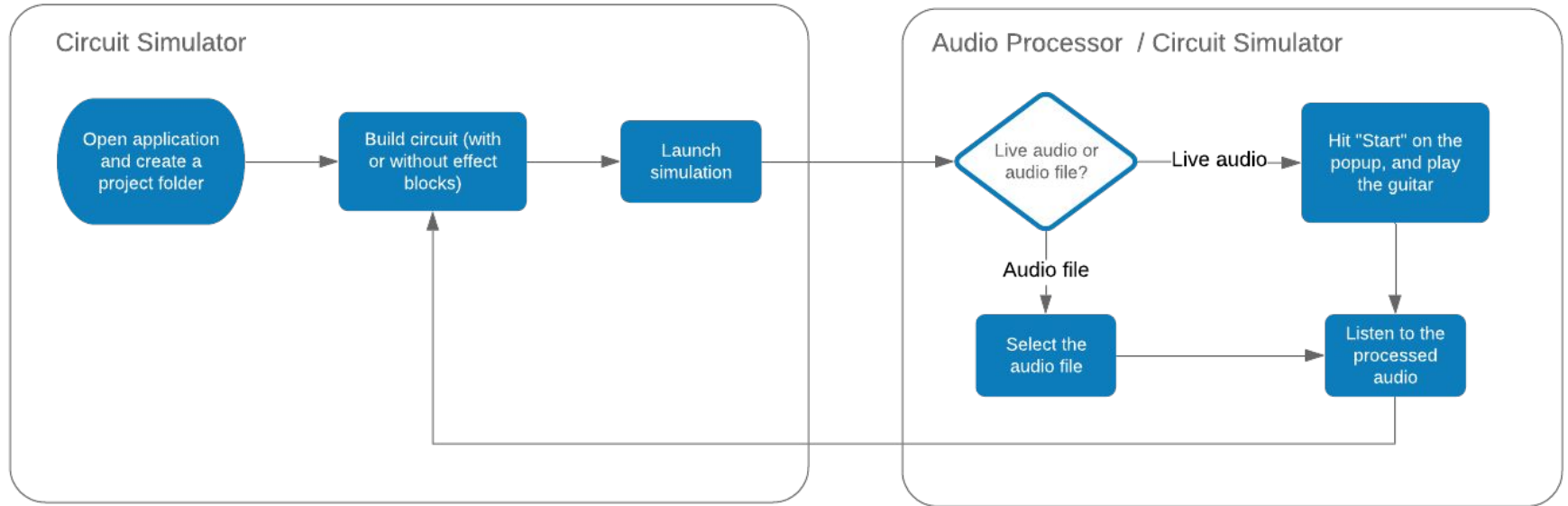- Provide output signal to Audio Processor

Audio Processor
- Routes audio input and output
- Selects between audio hardware and filesystem
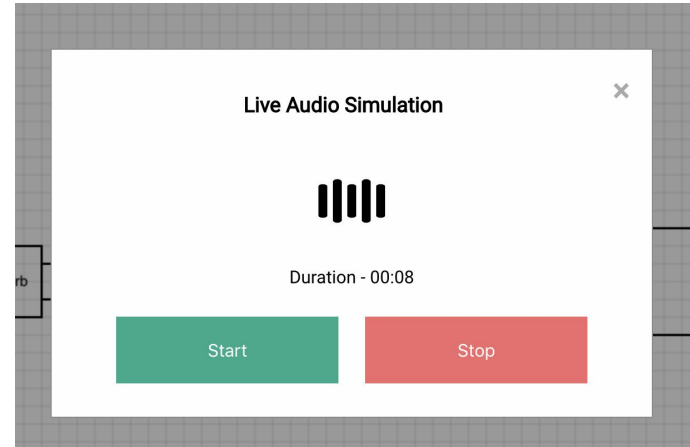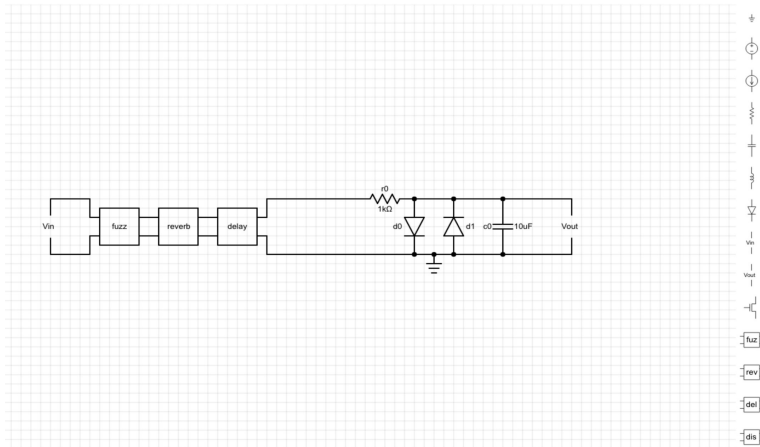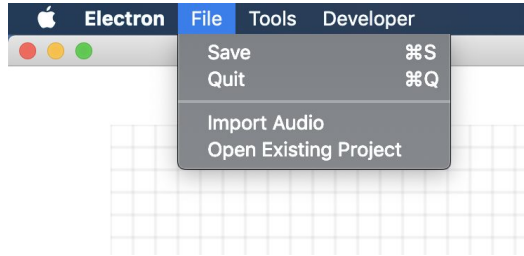- Communicates with the circuit simulator and UI

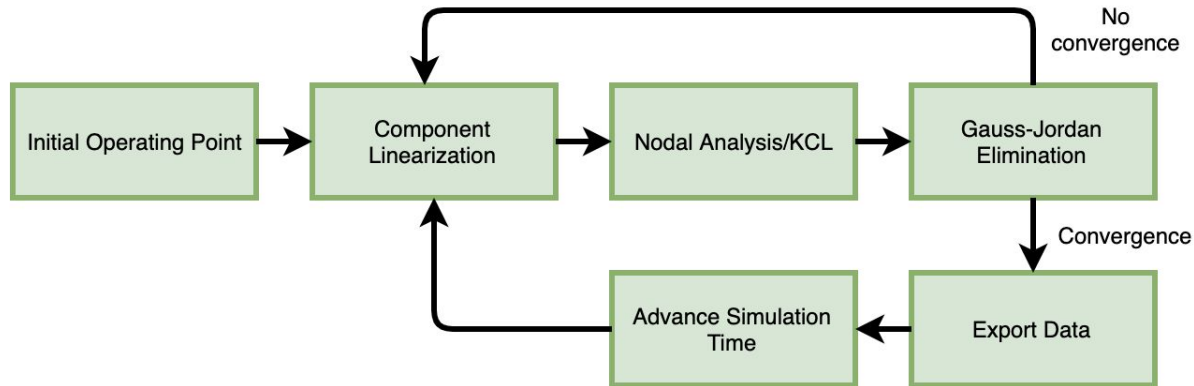# Our Solution

User Journey Flow

Frontend / User Interface

Backend - Circuit Simulator

- Supports resistors, capacitors, inductors, and diodes
- Uses Newton's method to approximate solution to KCL equations
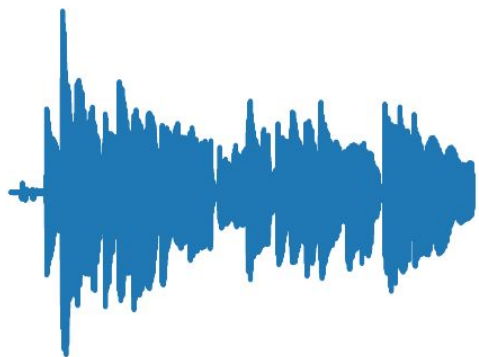- Written in C++ using Eigen matrix library
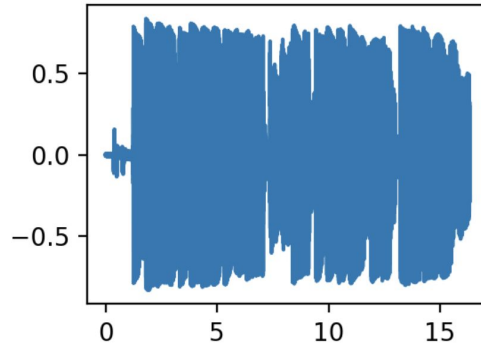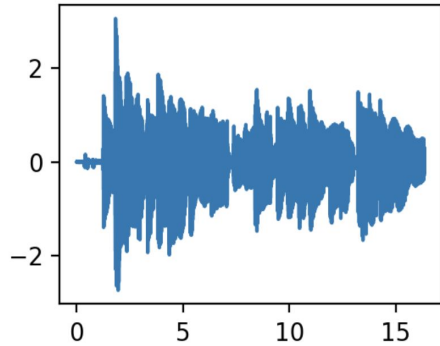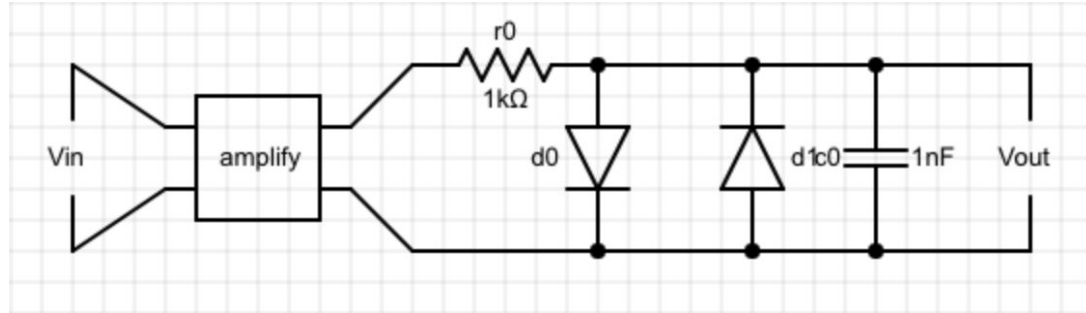
Backend - Audio Processor

- Supports multiplexing of hardware and file input/output.
- Dynamically sized read & write queue to manage communication with circuit simulator
- Pre-processed digital effects:
  - Fuzz
  - Distortion
  - Reverb
  - Delay
  - Amplify
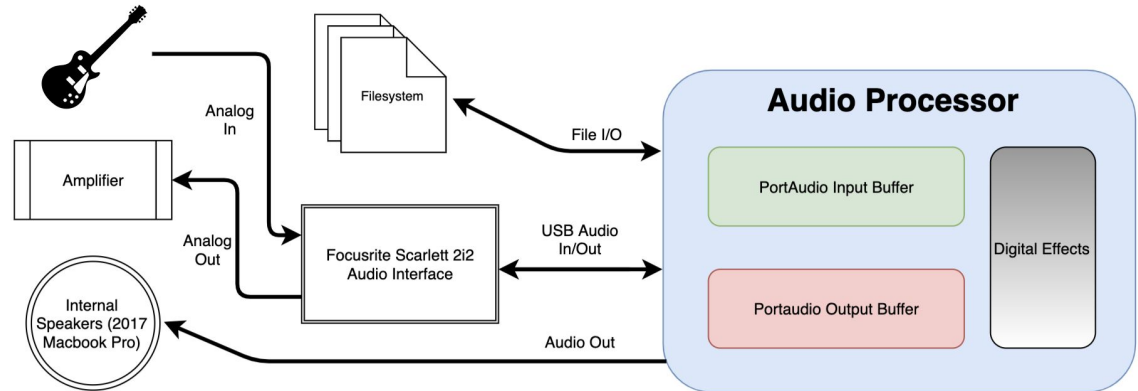
Results - Digital Effects
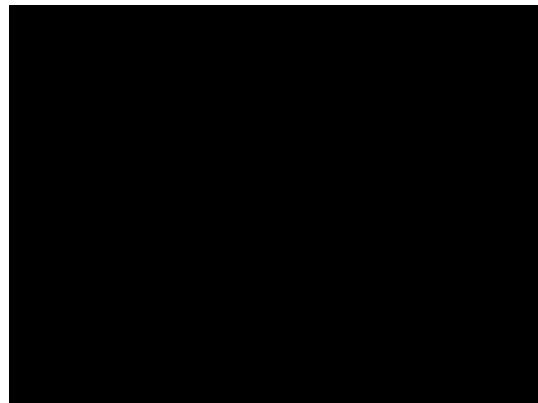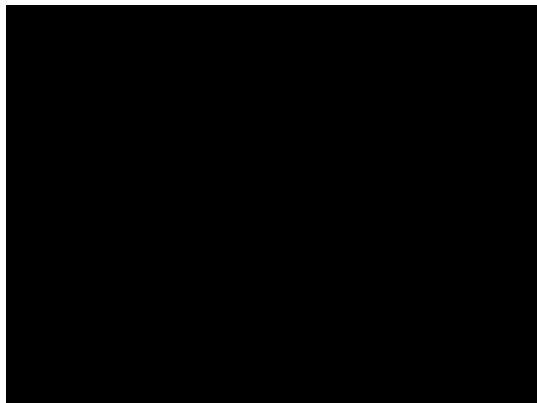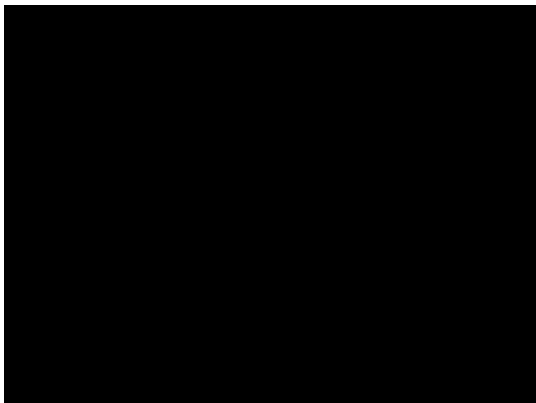
Results - Circuit Simulation

Metrics and Validation

- Survey of 5 people
- On a scale of 1 to 10, with 1 being most unsatisfied and 10 being most satisfied, how satisfied are you with our application?
  - 8.6 average
- On a scale of 1 to 10, with 1 being very difficult and 10 being very easy, how easy is it to use our application?
  - 7.4 average
- On a scale of 1 to 10, with 1 being very noticable and 10 being not noticable, how noticable is the latency with live audio?
  - 9.0 average
  - Average Latency: 23.2 ms (digital effects)

Schedule

- Develop slideshow for final presentation (04/27)
- Work on poster (04/28-04/30)
- In class presentation (04/29)
- Public demo (05/06)
- Work on final report (05/01-05/08)

Lessons Learned

- Keep everyone accountable!
- Stick to the agreed-upon schedule
- Circuit simulation is challenging
- Don't underestimate time spent on 'non-code'
- Write down what you've accomplished
- Don't rush the concept phase, do your research
  - Choose the right modules the first time