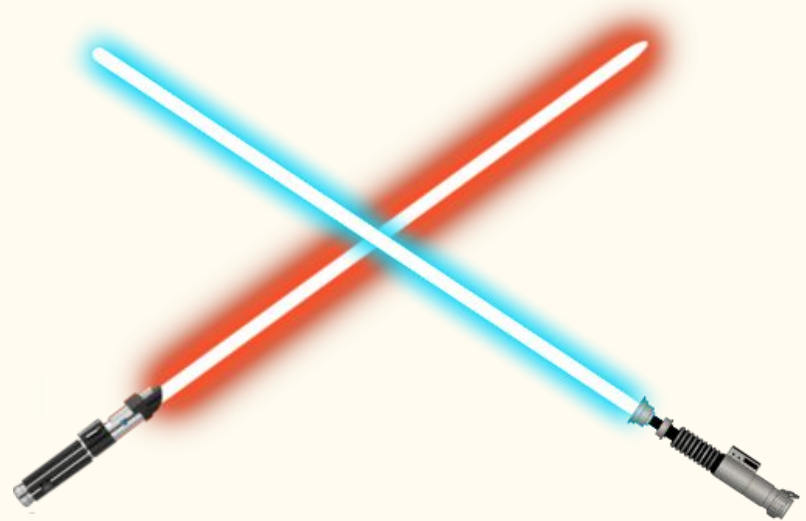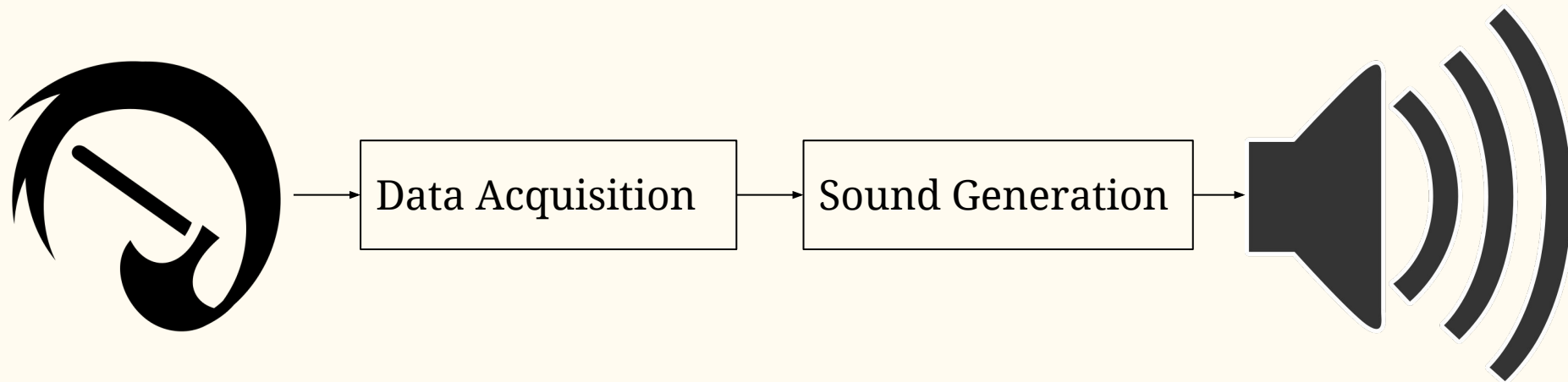# LightsaberFX

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Elizabeth Lee and Jing Wang

LightsaberFX

- Circuitry completely mounted on lightsaber
- Sound effects produced with movement
- Frequency and volume varies
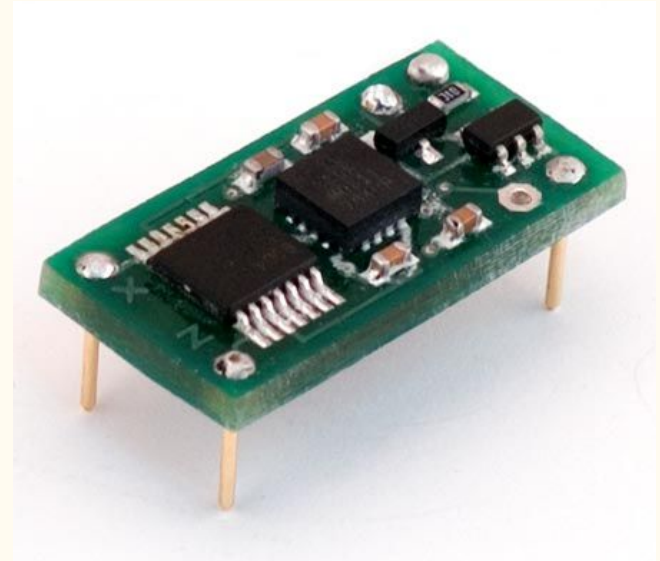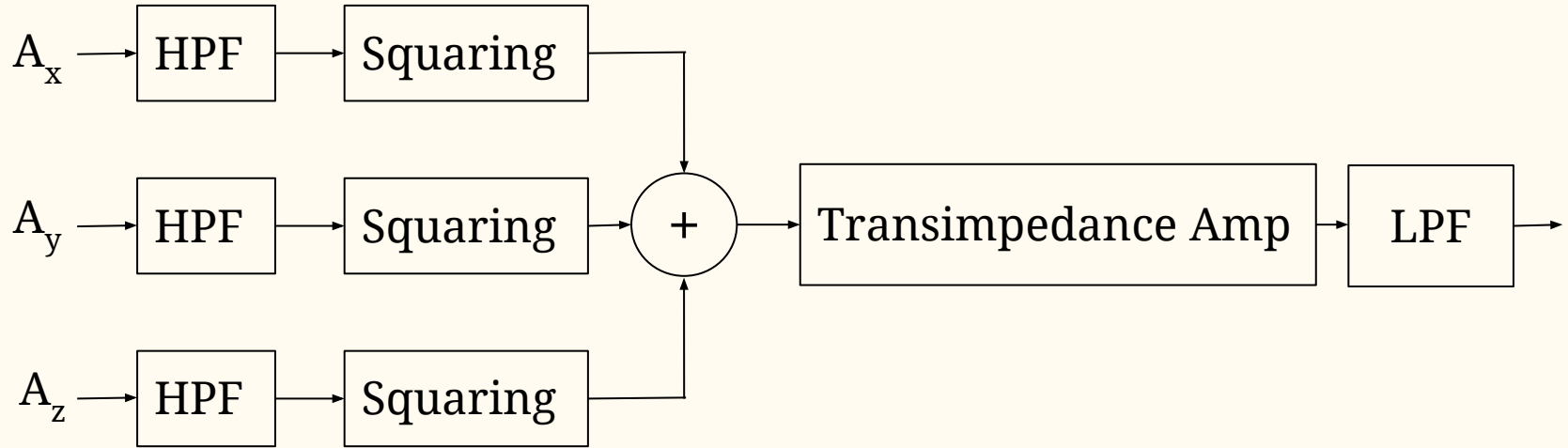- "Impact" noise when hit
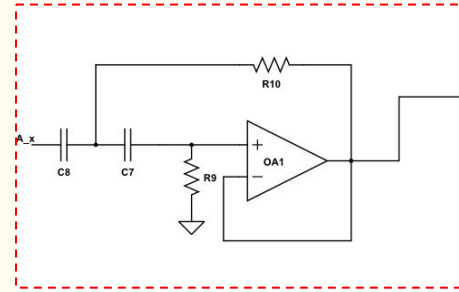- Run on 9V battery

Overview

Accelerometer

- DE-ACCM3D tri-axis accelerometer
- Voltage readings for acceleration in x, y, and z axes, including acceleration due to gravity
- 3.3V regulator
- Sensitivity: 300mV/g at 3.0V input to 360mV/g at 3.6V input
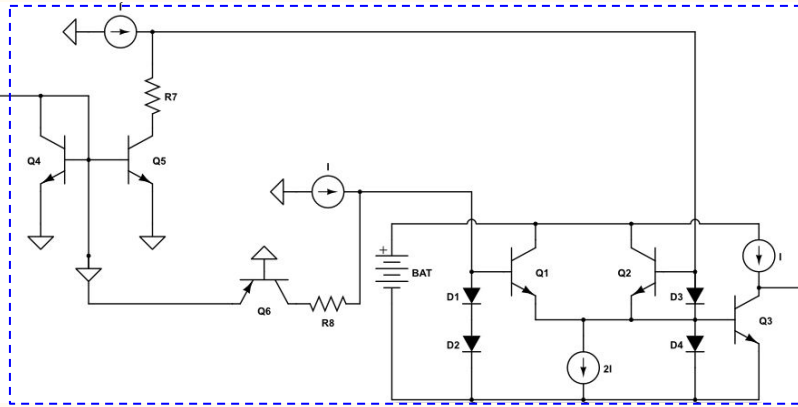- 0.9mA current draw

Movement Data Acquisition
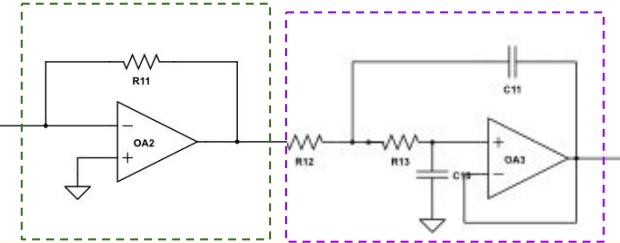
Movement Data Acquisition Up Close
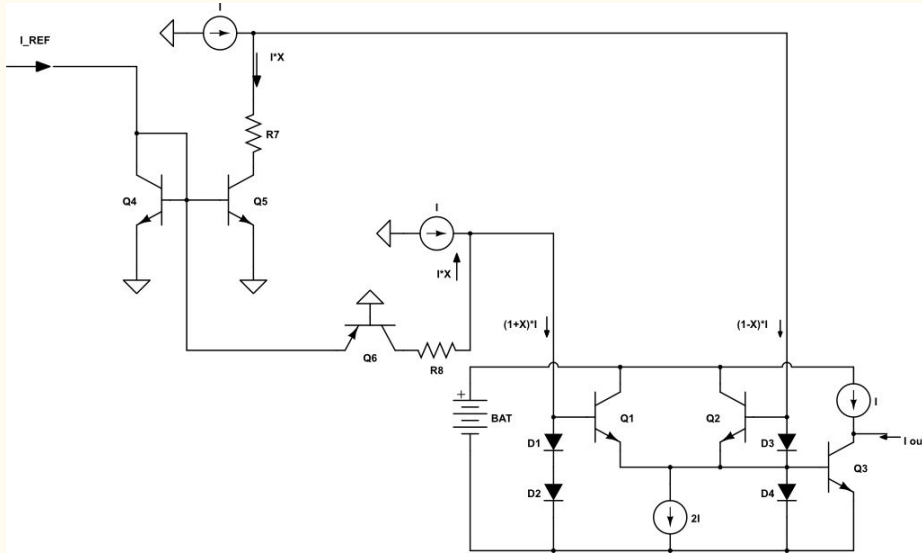

Sallen-Key HPF

Translinear Squarer

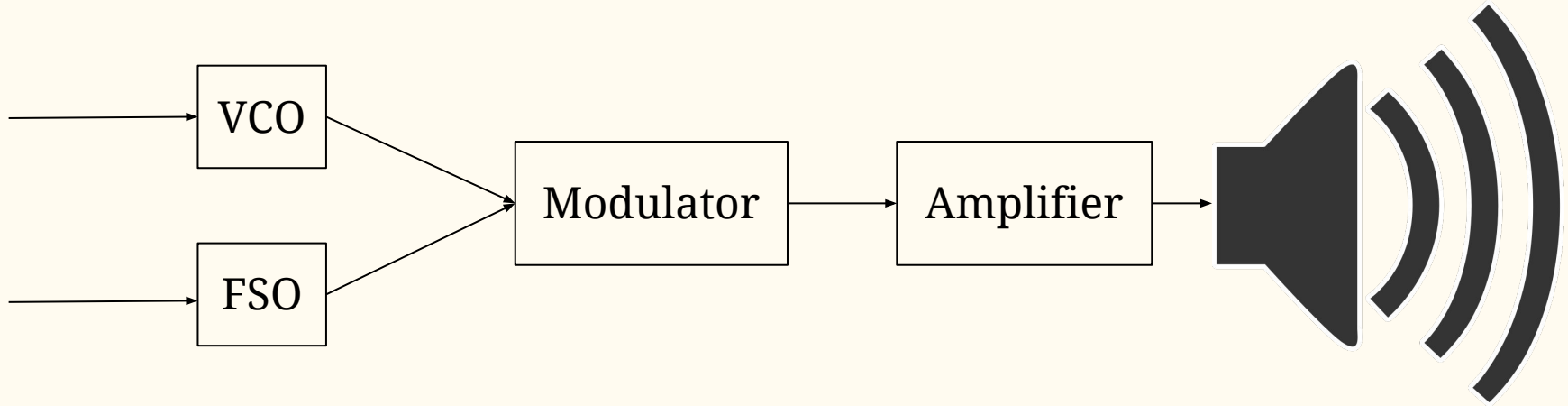Transimpedance Amplifier

Sallen-Key LPF

Squaring circuit

- Calculate total magnitude of acceleration
- Translinear circuit: current-dependent
- Currents generated by current mirrors

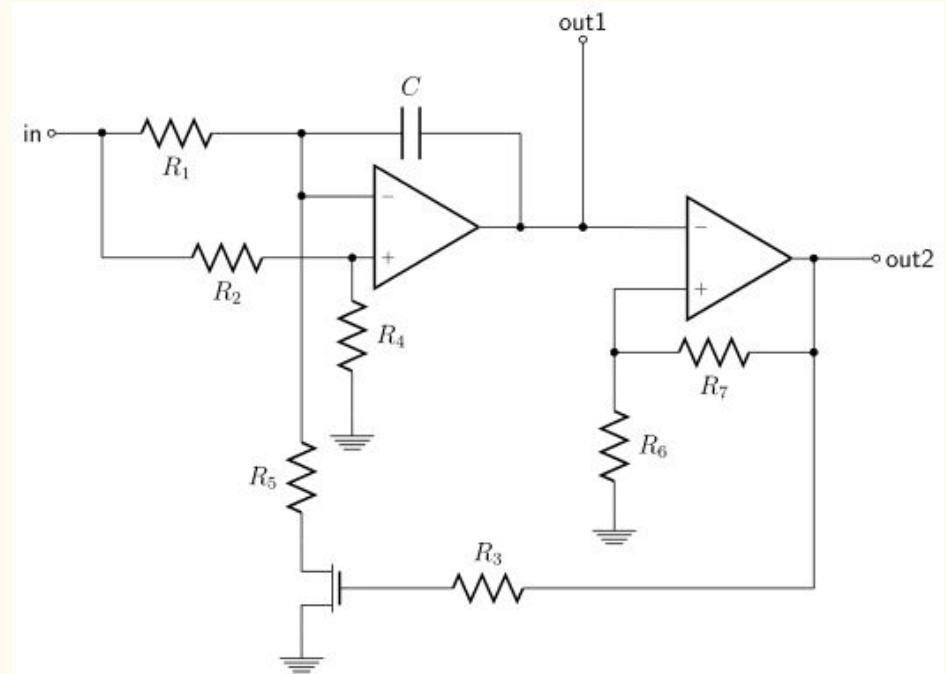- Disclaimer: This probably won't work.

Sound generation

Voltage Controlled Oscillator

- Frequency controlled by voltage input
- Serves as frequency modulation for audio output
- Carrier signal for AM modulation

Phase Shift Oscillator

- Phase shift oscillator for audio signal
- Power supply controlled by voltage input to control volume based on intensity of movement
- Audible range 20Hz - 20KHz
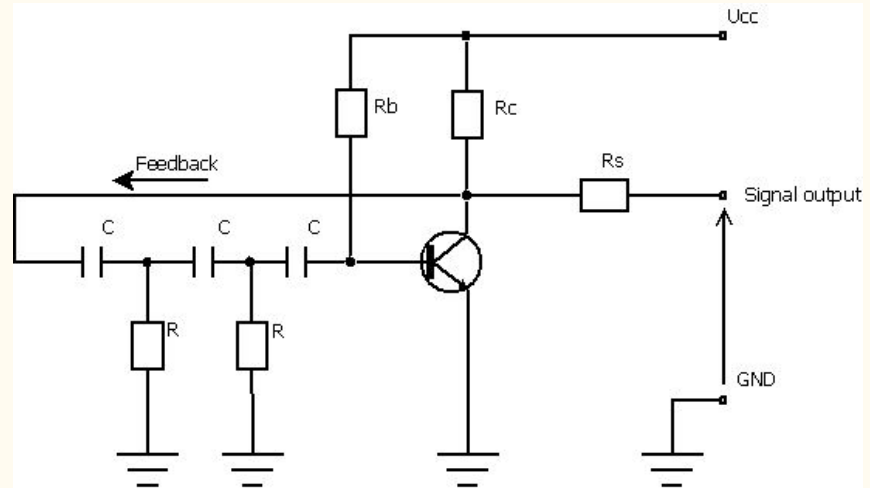
Amplitude Modulation

- Amplitudes of signals multiplied in AM circuit
- Transistor gate controlled by carrier signal with emitter offset by audio signal
- Produces modulated signal
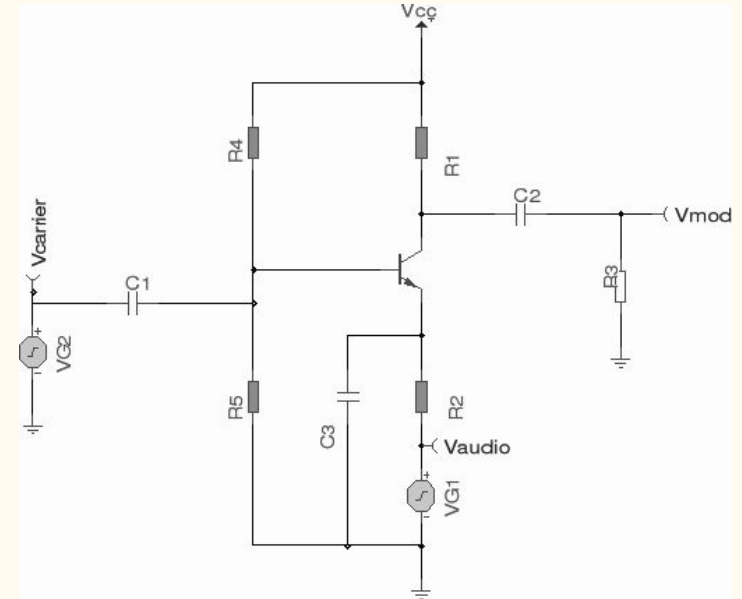
Goals

- 3-axis swishing sound effects
- Powered by 9V battery

Toe-Touch Goals

- Sound effects from impact acceleration
  - Comparator with high acceleration voltage
- System shuts off when not in use
  - Timer circuit

SPLITS

- Replace 9V battery with 2 1.5V AA batteries
  - Boost converter to step up voltage
- Mechanism that turns on lightsaber when movement threshold is reached

Boost Converter

- Ramp up voltage for voltage controlled oscillator
- Voltage gain of $1/(1-D)$, where D is the duty cycle
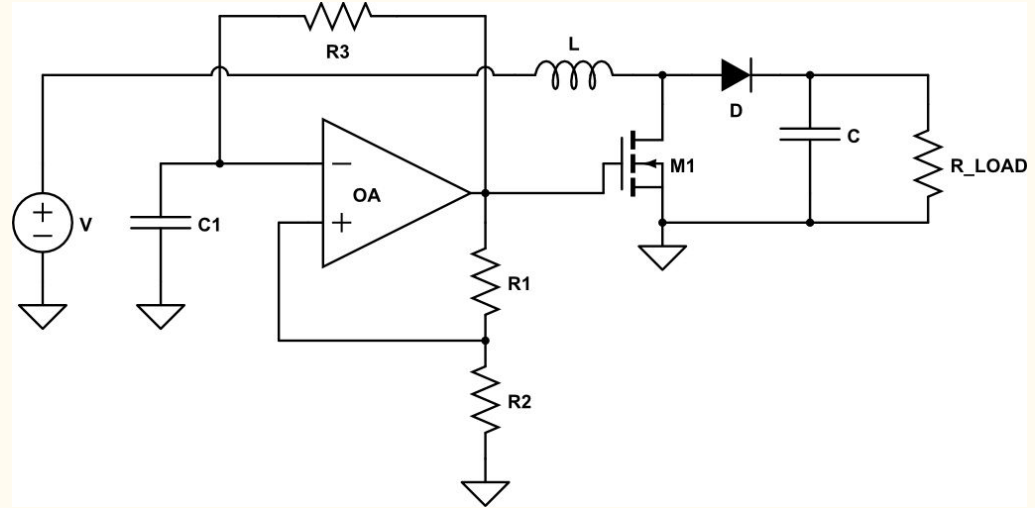
Timeline

4/23	Demonstrate sound effects for one axis
4/30	Incorporate all three axes and add hitting noise
5/4	Implement system timer circuit and try replacing 9V battery with 1.5V AA batteries If ahead of schedule, add movement-triggered on switch
5/7	Final testing and debugging
5/9	Project demo

Questions?