# RUTGERS
### THE STATE UNIVERSITY OF NEW JERSEY

# Modular Synthesizer

## Derek Hinsey, Shawn Fitzgerald
### {dwh50, smf196}@scarletmail.rutgers.edu
### Advisor: Prof. Waheed Bajwa

## Abstract

In 1955, two engineers at the Radio Corporation of America built the first electronic sound synthesizer. It was a primitive design, relying on punch-card input and delivering only a small range of sounds. Since then, many improvements to the design have been made. In this project, we have built an analog synthesizer. Our model takes advantage of a modular design, with each module realized as a circuit that affects the signal in a unique, customizable way. Our synthesizer delivers a wide-range of sounds due to user's ability to control attack, delay, sustain, pitch, echo, and wave shape.

## Motivations and Objectives

❑ Motivations

- A modular design allows the user to configure the synthesizer in many different ways, therefore achieving a unique sound which allows us to distinguish ourselves as musicians.

- Building the synthethizer will provide us an in-depth understanding of how circuits of a synthesizer work.

❑ Objectives

- Build a synthesizer that creates sound through a network or free-floating, interchangeable modules.

## Challenges

❑ Debugging
- The modules consist of highly-complex circuits, thus increasing the capacity to make errors in construction.

❑ Keyboard
- The keyboard required a changing resistance value to produce different notes. This was a mechanical design challenge.

## Acknowledgement

## Methodology

Flow Chart of Modules



User Patches Inputs to Outputs

**Voltage Controlled Oscillator**
- Creates waveform of desired frequency

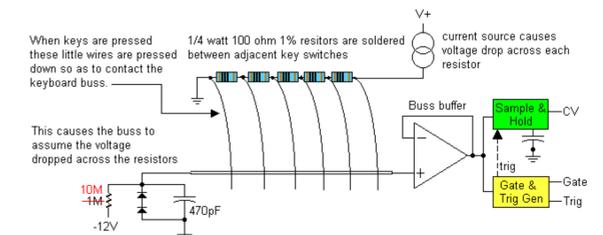**Envelope Generator**
- Controls attack, sustain, delay, and release



**Voltage Controlled Amplfiier**
- Controls ring modulation, vibrato, and stereo panning

**Keyboard Sample and Hold**
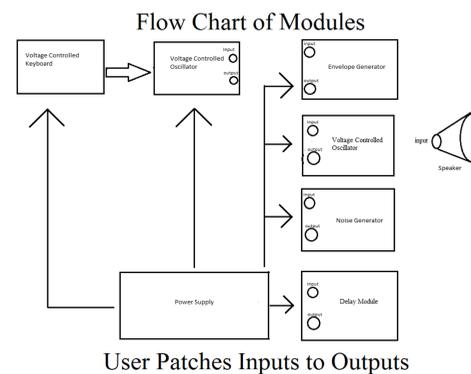- Sends voltages to the Voltage Controlled Oscillator to determine pitch.



**Echo Module**
- Creates an echo effect. The user can define the delay time, number of repetitions, and echo frequency.

**Noise Generator**
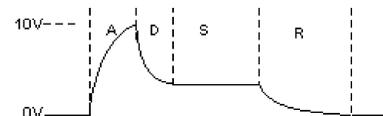- Adds noise to the signal to create a distorted sound.

## Results

**See our demonstration for a stronger visualization of results.**
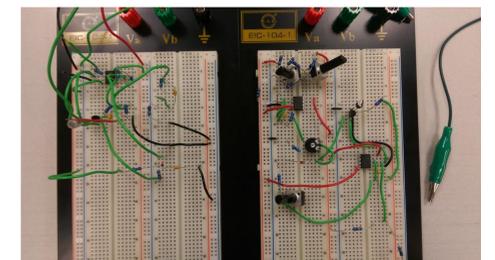
**Ramp wave output**
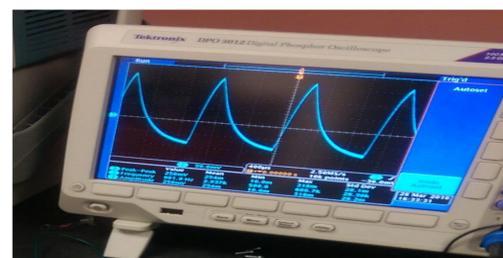


**Keyboard Controller Resistance Chain**



**Voltage Controlled Oscillator Circuit**



**Future Work**
- Add and take away modules as we see fit.
- Make casings more aesthetically pleasing

## References

[1] http://musicfromouterspace.com/
[2] http://www.edparadis.com/keyboard/
[3] Make: Analog Synthesizer by Ray Wilson