

E2.O1: The Lords of Synth Analog Synthesizer

Jacob Sees, Claire Akers, Miles Keyser, Charles Morales

The rising STAR of Texas

PURPOSE

What?

Demonstrate skills from prior coursework in Circuits, Signals & Systems, and Electronics.

Why?

The project connects engineering skills to a common interest-music.

How?

Build an analog synthesizer capable of playing the fourth Octave in tune when connected to a keyboard.

BACKGROUND

The industry standard for synthesizers makes use of the 1 Volt/Octave standard. Our System:

- Makes use of the 1 Volt/Octave standard
- Capable of outputting the 4th octave
- Utilizes various control voltage devices

APPROACH

- **Microcontroller Test Unit (MCU):** Test System with Linear or Exponential Voltages.
- **Linear-to-Exponential Subsystem (LTE):** Scales Linear Input Voltages and Brings System in Tune.
- **Voltage Controlled Oscillator (VCO):** Produces three waveforms with frequencies in the 4th Octave.
- **Speaker Subsystem:** Amplifies signals to 75 Decibels at 1 Meter.
- **Power Supply Unit:** Uses Four 9 V Batteries, 2 for the system and 2 for the speaker, to allow 4-hour runtime playing at 75 dB

ACKNOWLEDGMENTS

Sponsor and Faculty Advisor:

Dr. Cecil Compeau

E2.01 THE LORDS OF SYNTH



Jake Sees



Miles Keyser



Claire Akers

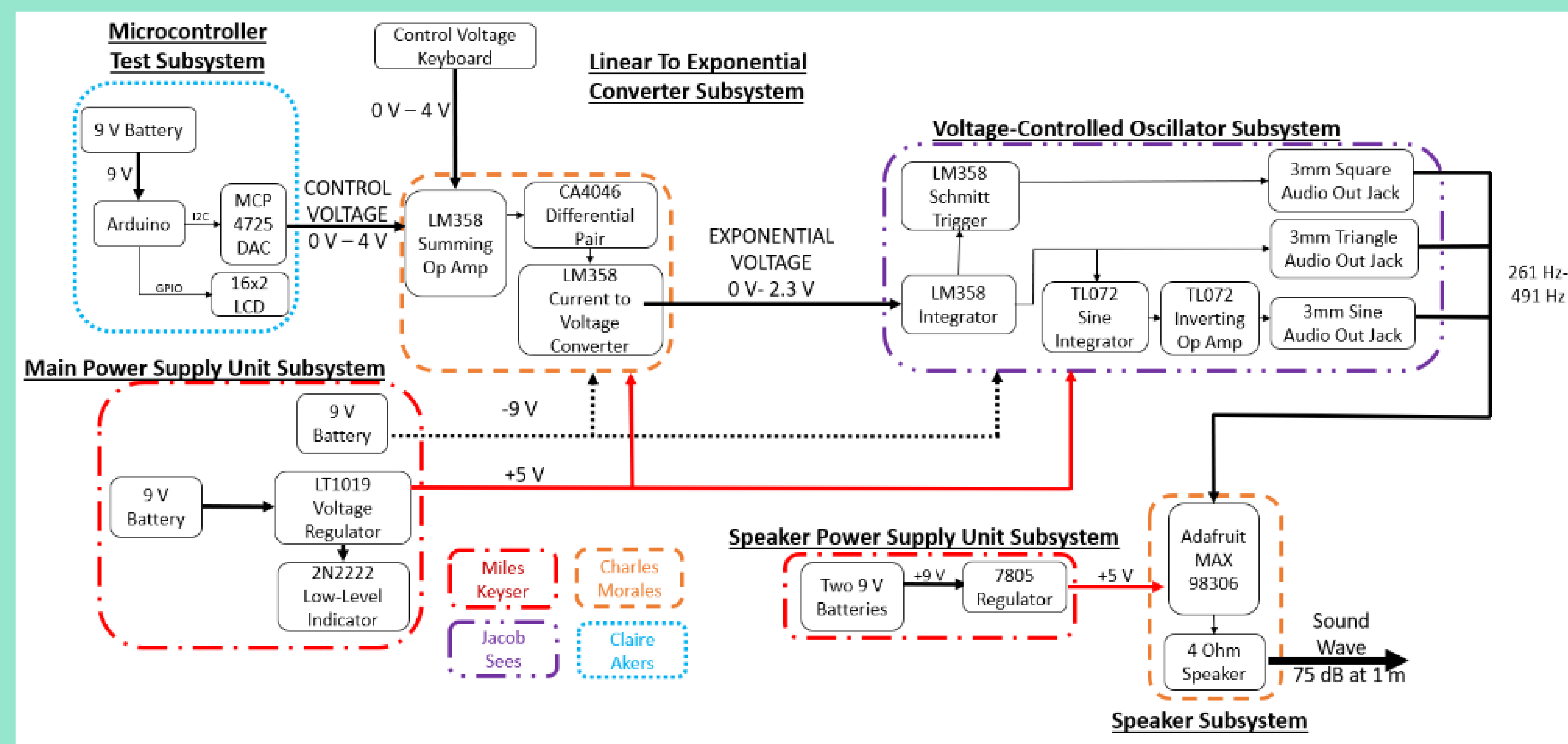


Charles Morales

PROJECT GOALS

- 1 V/Octave Keyboard Controlled
- A4 = 440 Hz tuning within 12 cents
- Built-In Speaker reaching 75 dB at 1 m
- 4 Hr. Battery Runtime
- Low-Voltage Indicator
- Produces Sine, Triangle, and Square waveforms
- Arduino Voltage Output Test Bed

SYSTEM BLOCK DIAGRAM

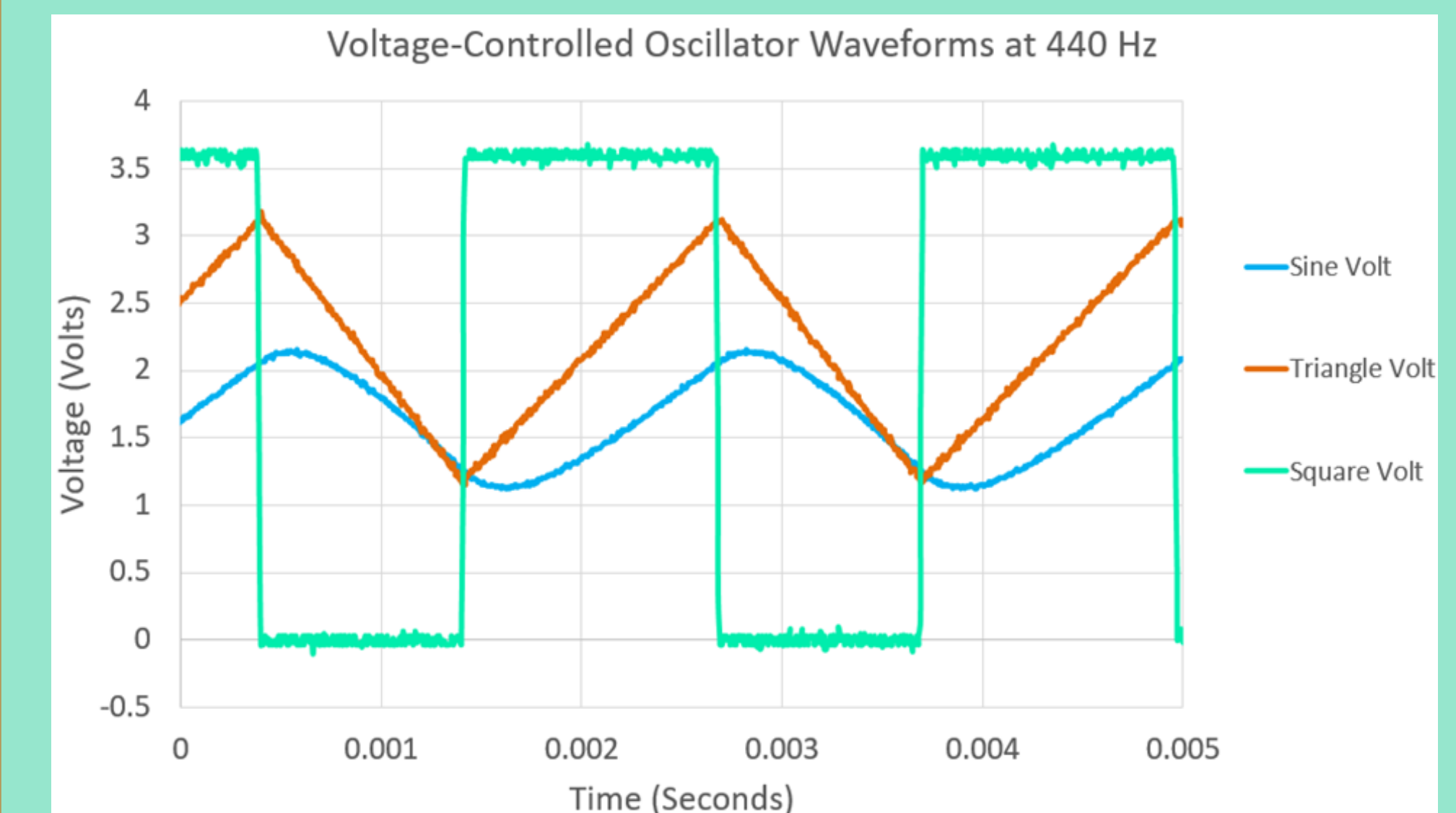


Achieved Stretch Goals in the Final Synthesizer

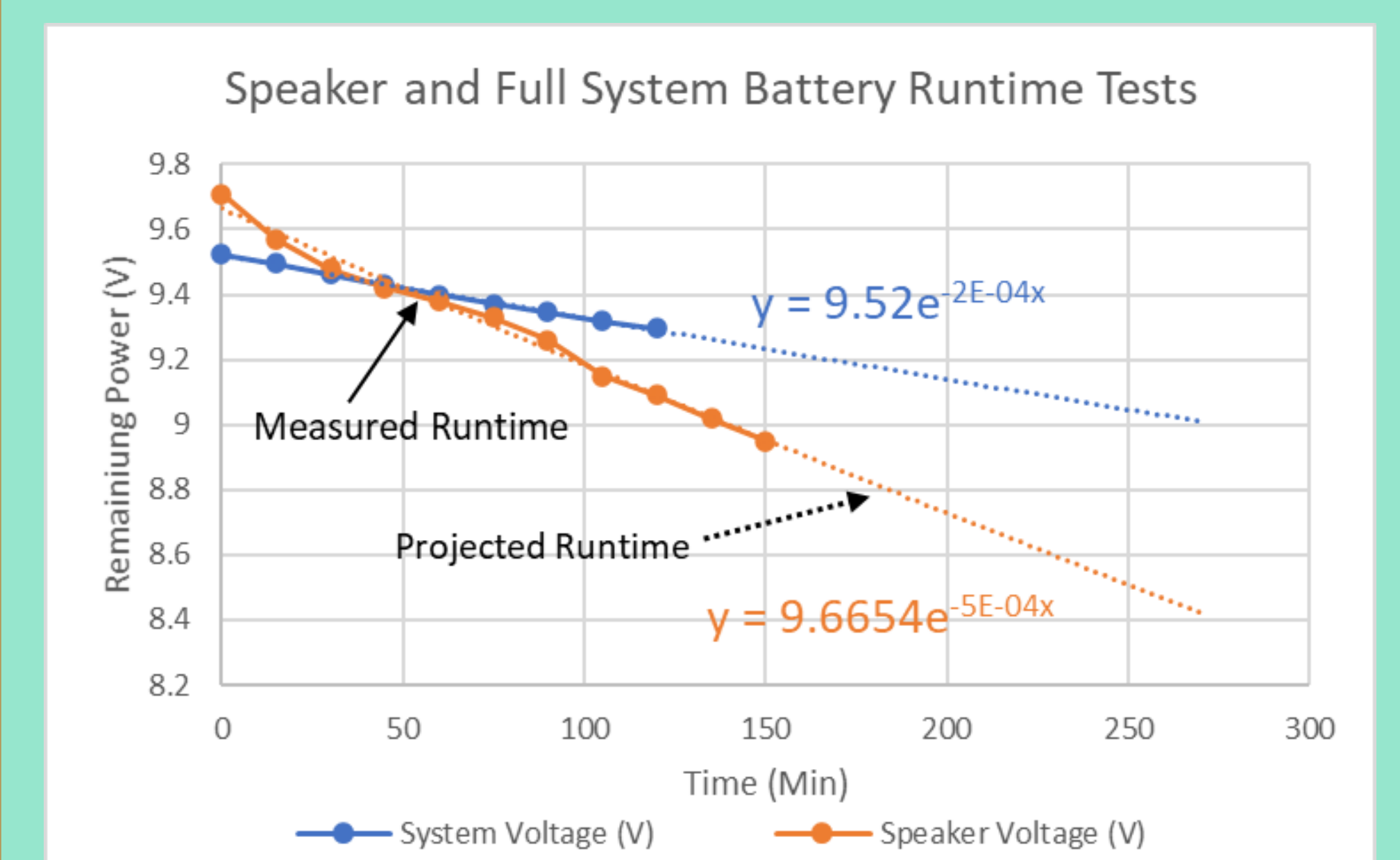
- **Attack, Decay, Sustain, Release Module (ADSR):** Adds ability to shape signal envelopes
- **Voltage Controlled Filter (VCF):** Adds Adjustable Low-Pass Filter; Combines VCO signal with ADSR Envelope

SPONSORED BY DR. COMPEAU AND TEXAS STATE UNIVERSITY

SELECTED RESULTS



Square, sine, triangle waves shown at 440 Hz, the project's target frequency.



Runtime test shows two hours of operation at 75 decibels, with projections for the full four hours after three trials.

FINAL PRODUCT



This is the final product. The synthesizer is inside the case and is completely functional.