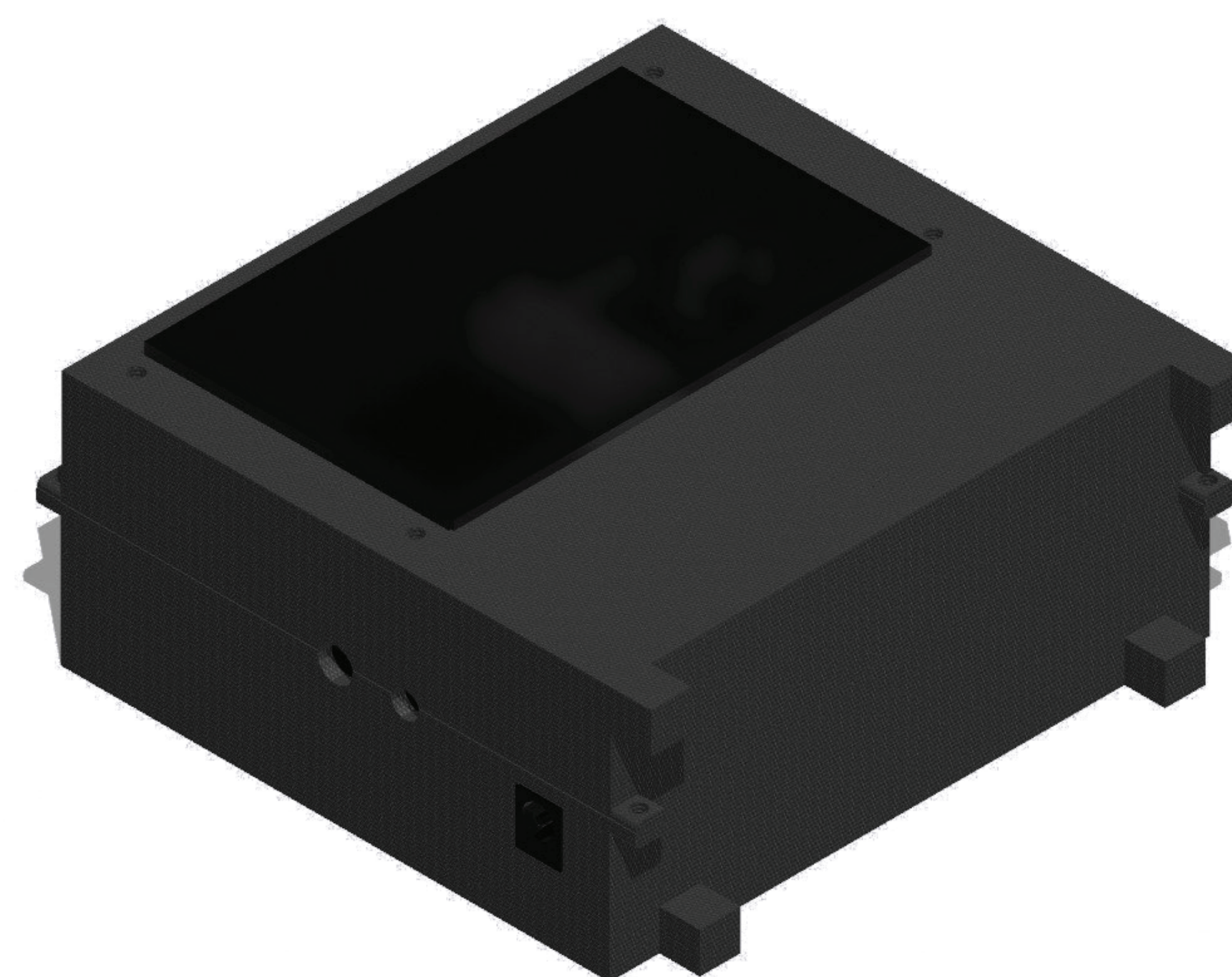# SDSU
San Diego State University
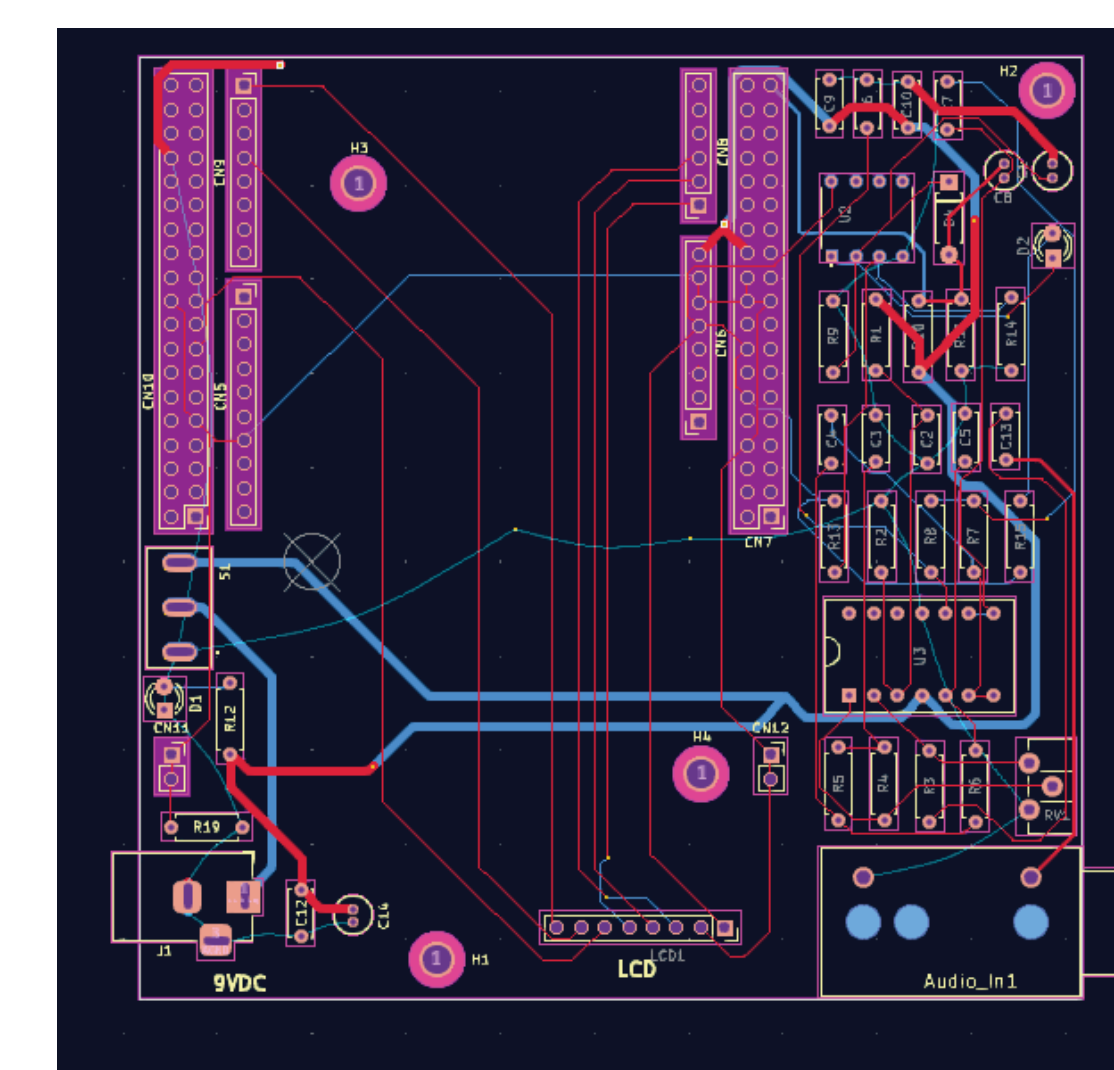
Audio Visualizer
Created by The Noizy Boyz

Project Overview

This device is a real-time audio spectrum analyzer, designed to capture audio signals from a handheld dynamic microphone, identify dominant frequencies in up to a 5kHz range, and display these frequencies on a 320x480 LCD screen. It performs these operations using the STM32 Nucleo-G4 development board along with analog circuitry to ensure the system remains a steady, real-time system. Its 5kHz range makes it well-suited for analyzing vocal frequency spectrums, as well as applications where moderate audio quality is sufficient.
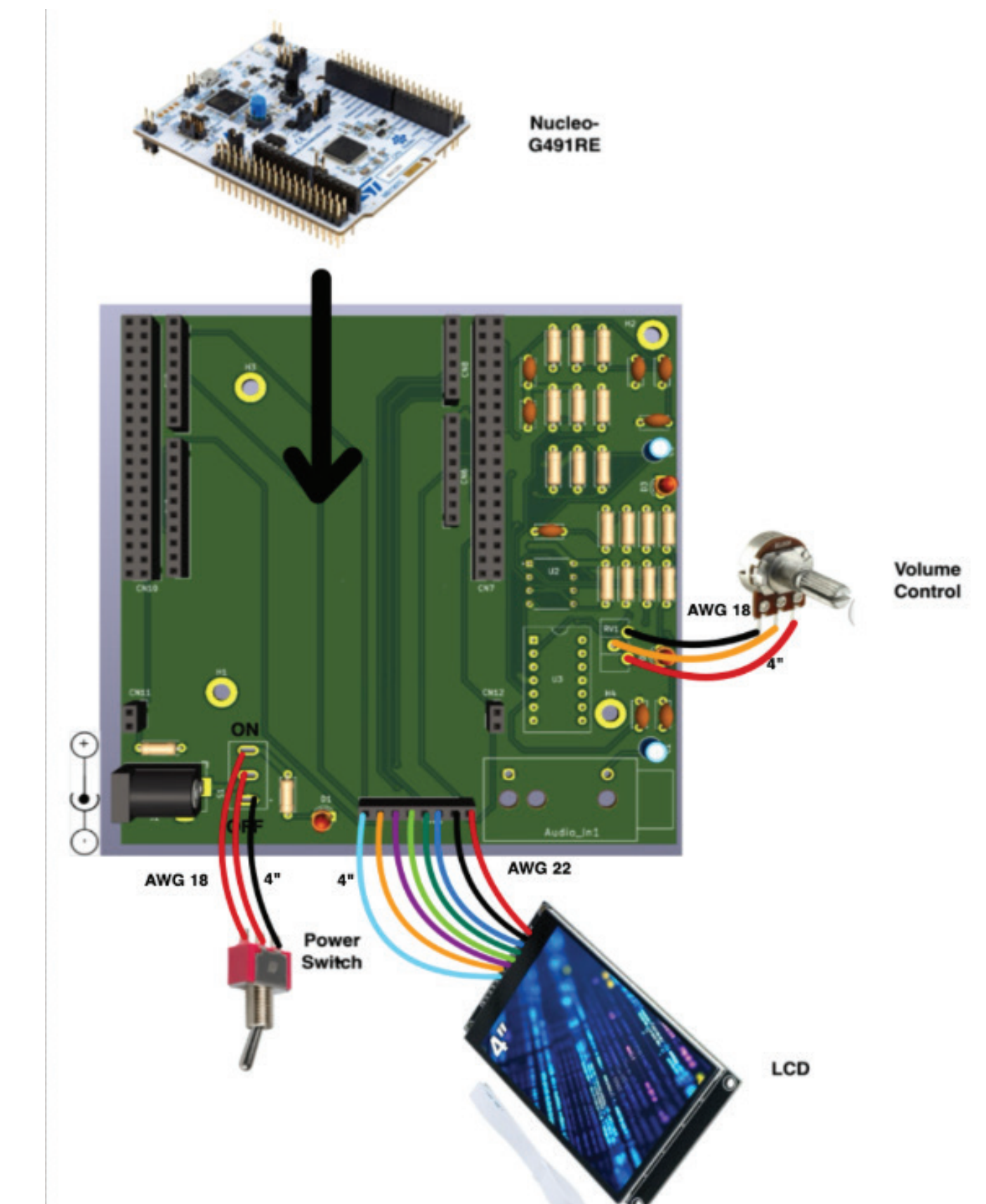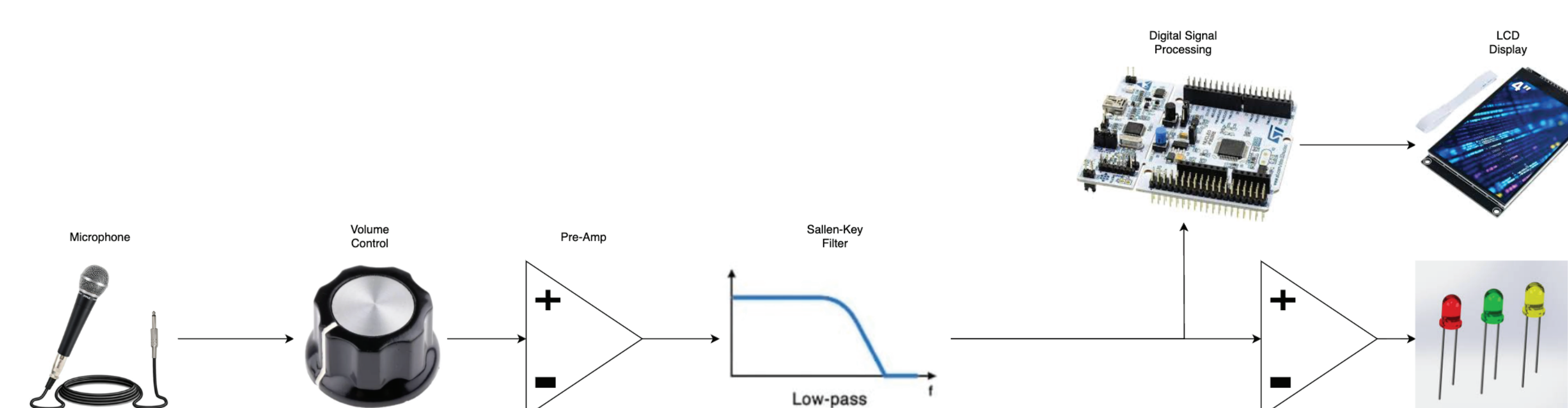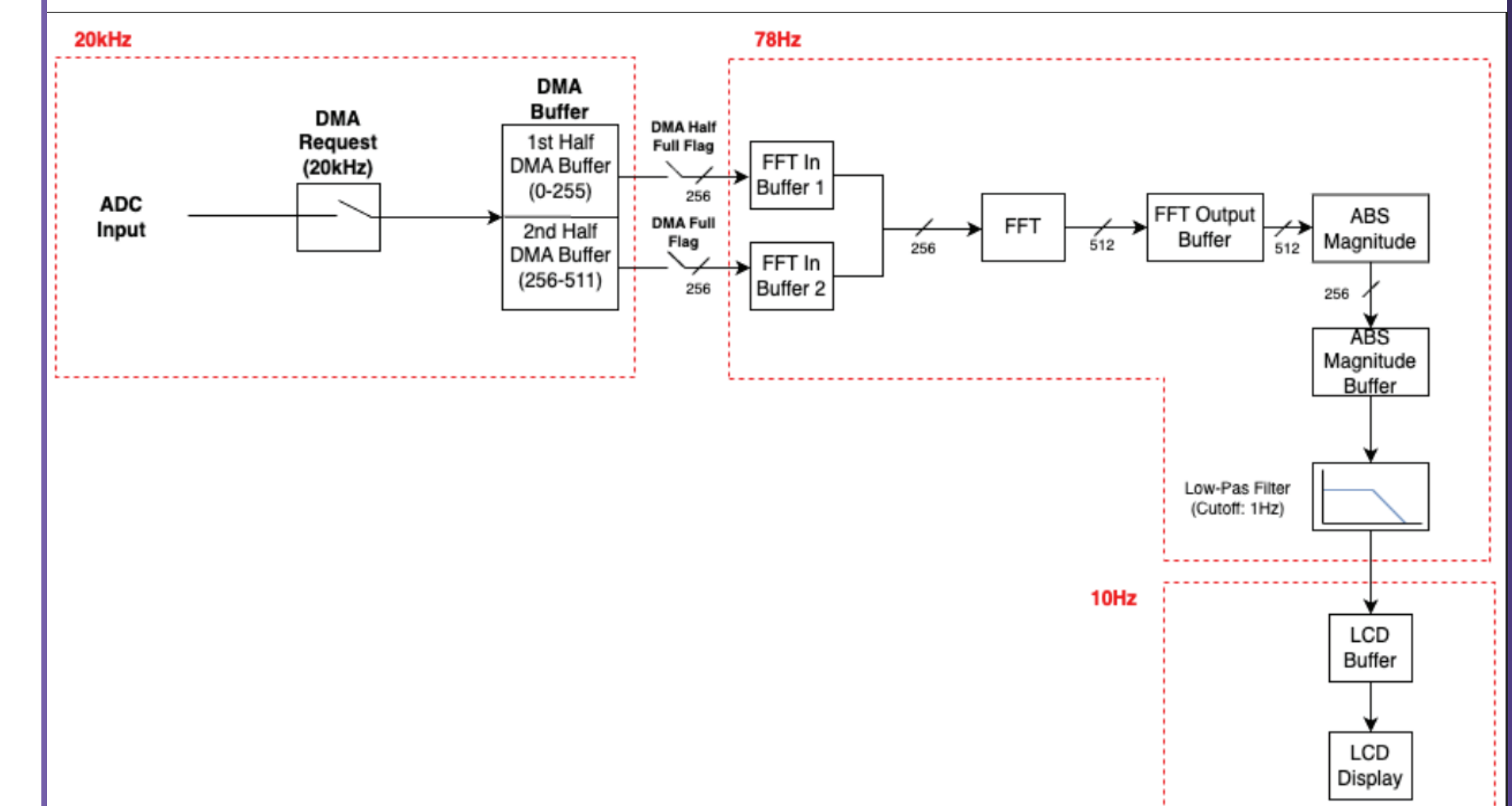
Key Components

- **Clipping Detector:** Circuit created to light LED if set voltage level is exceeded
- **Sallen-Key LPF:** Passband -3dB @ 5kHz, Stopband -50dB @ 15kHz
- **Input Power (DC):** 9VDC @ 1A
- **Microcontroller:** STM32 Nucleo-G491RE
- **LCD:** 4", 320 x 480, 16-bit color
- **Microphone:** Pyle PDMIC58, Unidirectional
- **Enclosure:** 90mm x 100mm x 30mm, Plastic

Meet the Team

Erik Shimizu
CompE

Enrique Rodriguez
CompE

Nero Hamidi
EE

Auston Knight
EE

System 3D Model

PCB Design

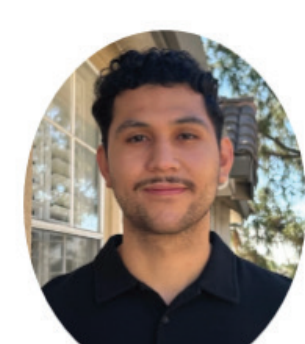

Wiring Diagram

Full System Block Diagram

- **Software:** Microphone signal is input from ADC, sampled at 20kHz, then feeds into a two-step DMA process to optimize time. An FFT is computed for each of the 16 bins shown on the display, as well as its magnitude, and a digital low-pass filter is applied to reduce rapid height variations. This information is then sent via SPI to the LCD display.

- **Hardware:** Provides Volume Control circuitry, into an analog Sallen-Key low-pass filter at 5kHz, which then gets fed into the digital components. A clipping detector is also included that lights an LED when any harsh clipping is detected.

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