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Intro

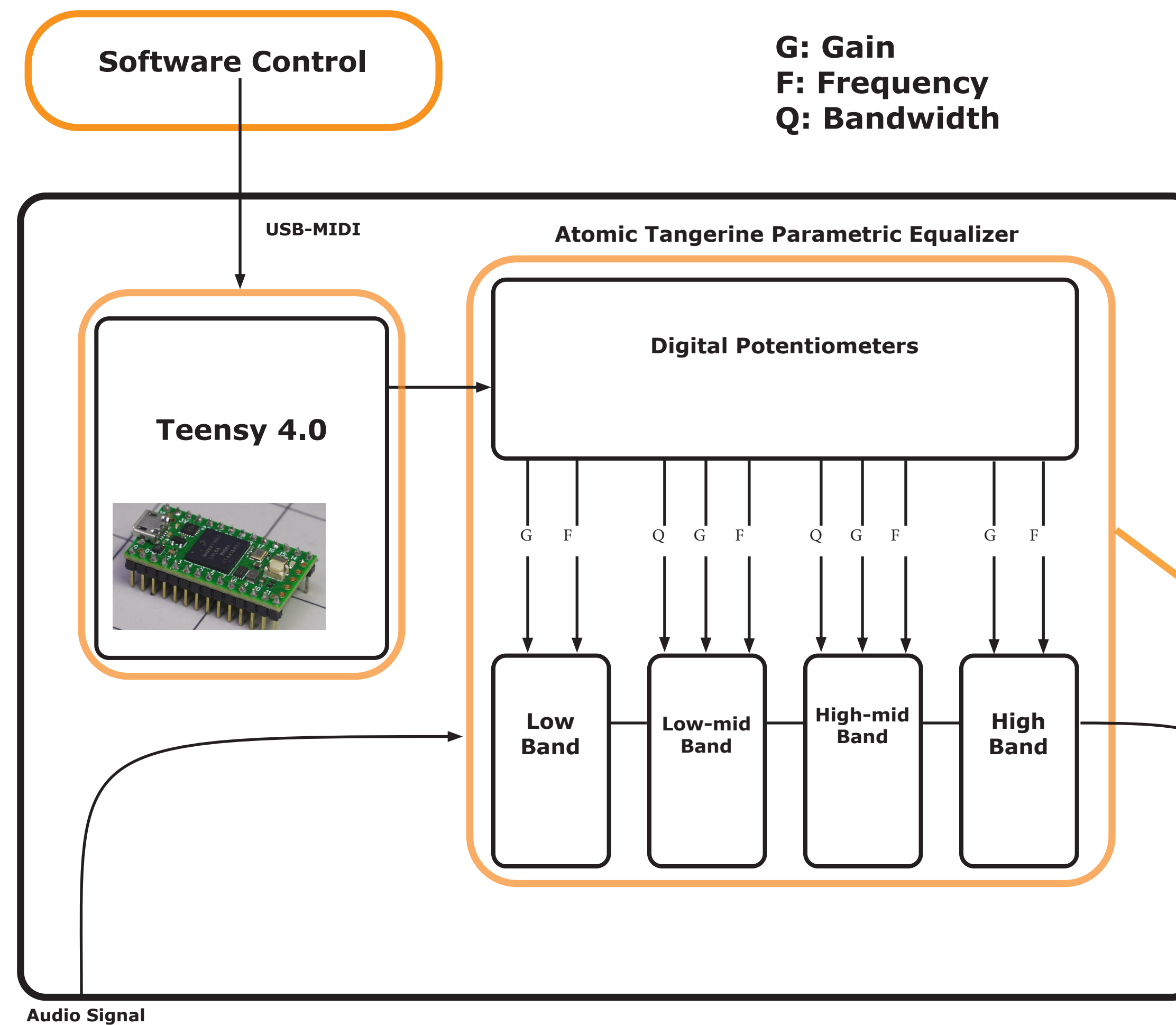
In today's audio production landscape, there's a divide between analog and digital audio processing. Digital devices are easy to use and cheaper, though analog devices provide a unique sound quality that many musicians prefer. To bridge this divide, our project aims to create a digitally-controlled analog equalizer, providing the user-friendly digital interface of many devices with the sound provided by analog hardware.

Goals

- **Analog parametric equalizer:** Build a fully functional parametric equalizer with a balanced line, low and high band shelving filters, and low mid and high mid peaking/notching filters.
- **Digitally Controlled Parameters:** Control all parameters of all bands digitally.
- **MIDI Control:** an encoding of control signals over USB communication

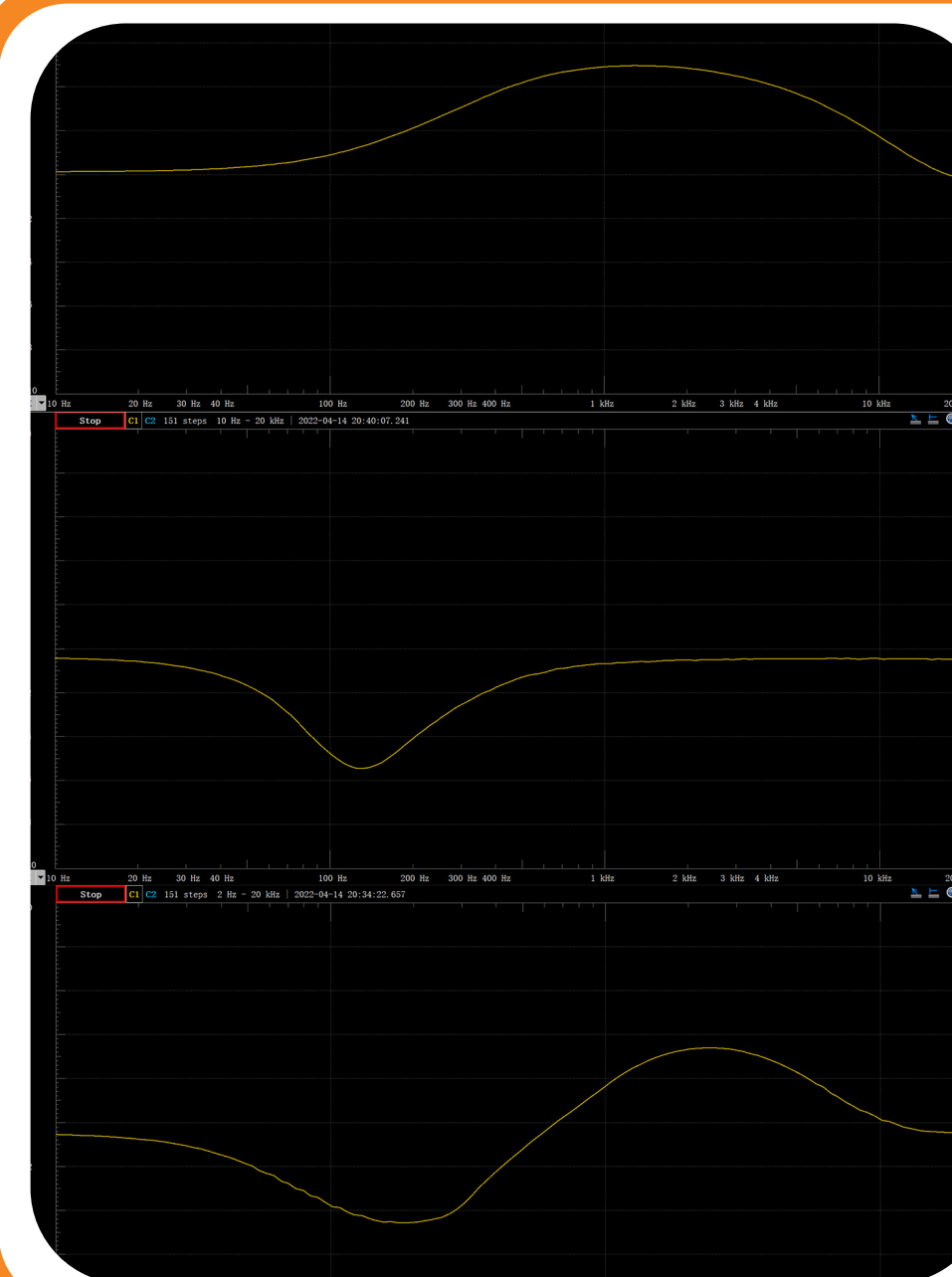
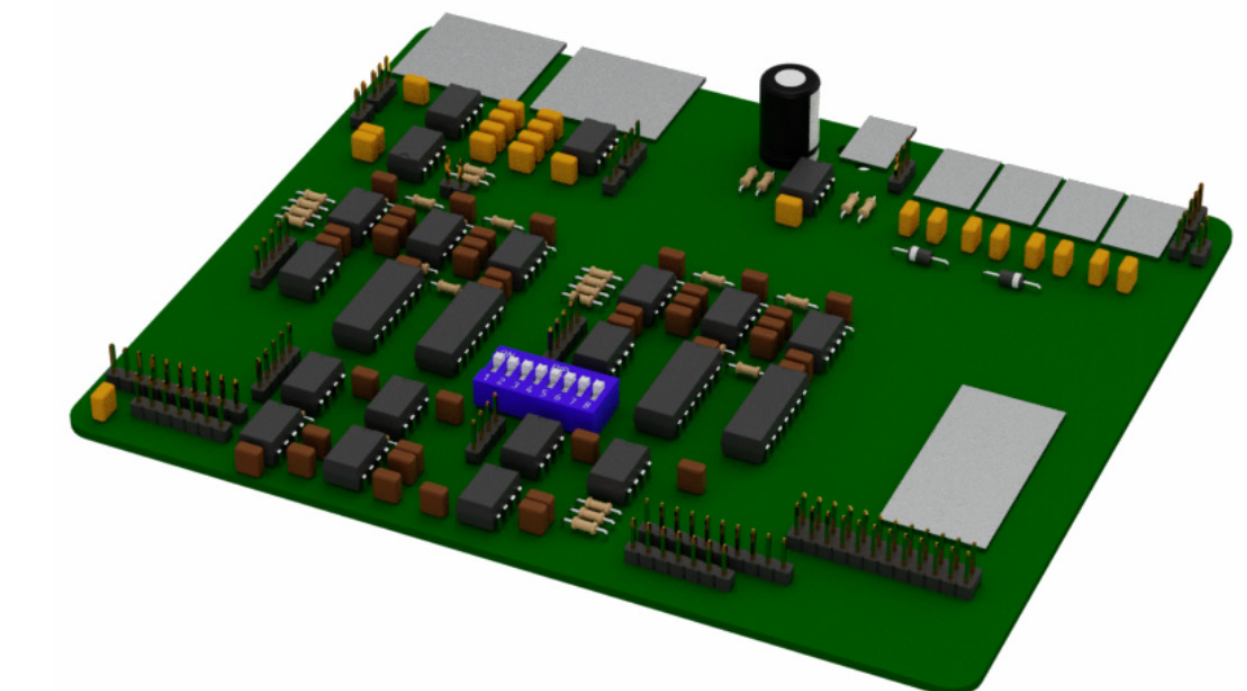
Accomplishments

- **Analog Equalizer:** A functional circuit containing low-mid bandpass and high-mid bandpass filters to control an audio signal.
- **Digitally Controlled Parameters:** Using digital potentiometers controlled by an embedded system, the gain, frequency, and quality factor of an audio signal are controllable.
- **MIDI Control:** Communication from a laptop to the device has been achieved over USB using MIDI encoding.



Challenges

- **Scale:** Our original goals for this project were very large-scale, and our product had to be scaled down as we encountered debugging challenges
- **Analog power delivery:** Once PCBs had arrived, incorrect pin mappings led to our expected power delivery method to be unusable, requiring an off-board power supply.
- **Software compatibility:** Certain software was incompatible, requiring unexpected time resolving compatibility issues



Shown on the left are frequency responses ranging from 20 Hz to 20 kHz. The top most image shows the high mid band being applied. The middle image shows the low mid band being applied. The last image shown applies both of these filters at the same time.

Future

- **More User-Friendly Interface:** by presenting controls using a Digital Audio Workstation (DAW) audio professionals would be familiar with, which would require conversion of user input to MIDI signals.
- **Graphical Feedback:** user-friendly plots displaying the response of the equalizer could be incorporated
- **Various Analog Circuits:** this control scheme could be extended to other audio devices, allowing for more manipulation of audio signals