Abstract:
Musicians face a huge obstacle when their instruments are out of tune. What makes it even more of a challenge is when they’re tuning their instrument in a noisy environment. Piezoelectric crystals/PZT (lead zirconate titanate) material can be used to eliminate distractions allowing musicians to tune their guitar in any environment.

Technical Objective:
- To develop a guitar tuner that allows the user the ability to tune their guitar in any environment accurately.
- The user will play each sting with the guitar tuner attached. The OLED will then display the note being played and how off tune each sting is.
- The PZT searches for the exact frequency of a vibration, which allows the guitar to be tuned more accurately.

Block Diagram of Overall Project:
1. Phidget Piezo Electric (PZT) Sensor
   - PZT Sensor converts vibration to electrical charge
   - Charge Amplifier read-out circuit converts current to voltage
2. Arduino
   - Digitally samples vibration signals by executing Fast Fourier Transform
3. OLED Micro Graphic Display
   - 128x64 screen to display tuning scale and note

Results:
- The frequency detected is within the range of G
  - “#” indicates the note is too sharp
  - “b” indicates the note is too flat
  - Thumbs up is a perfect note

Future Plans:
- Minimize the size of the components
- Develop a smaller PZT sensor with the correct resonant frequency
- Integrate the clamp, sensor, and display into one compact unit for a more aesthetically pleasing design
- Improve rejection of multiple harmonics

Commercialization Plans:
Hurdles to commercialization are the abundance of clip-on guitar tuners currently available, as well as the lack of an appealing physical design with the current size of the components.

This project was mainly undertaken to learn about the use of piezoelectric technology as it relates to sensing vibrations. Our ability to gain experience in basic digital signal processing and embedded systems coding was another main focus for us.