SMARTune

Team 10: The Tune Squad
The Team

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System Overview

- A bass guitar that uses DSP and DC motors to physically tune automatically.
  - Lower barrier for beginners
  - Convenient for professionals
Objectives

● The device automatically tunes a bass guitar within the just-noticeable difference.
  ○ +/- 5 cents
● The device tunes the bass guitar in 15 seconds or less.
● The device allows for the user to specify custom tuning presets.
System Architecture

- User
- User Input
- Pickups
  - Induced signal
  - String Vibration Signal (Strum)
- Microcontroller
  - User control signals
  - Motor Control FWD/REV Signal
- Power Supply
  - 3.3V
  - 9V
- Tuning Mechanism
  - Manual Tuning
  - Colors indicate physically separate systems

Connections:
- User to User Interface
- User Interface to Pickups
- Pickups to Microcontroller
- Microcontroller to Tuning Mechanism
- Tuning Mechanism to User
- User Interface to User Input
- Power Supply to Microcontroller
- Power Supply to Tuning Mechanism
Pickups

- PolyPhonic type

- Physically separate string signals
User Interface

- 16x2 LCD screen
- 4 navigation buttons
- 1 enter button
- 1 on/off switch
- Contrast control
Microcontroller - BBB

- Beagle Bone Black
- 12 bit ADC
- 1 GHz processor
- FFTW library
- Up to 65 GPIO pins
Microcontroller - Signal Sampling

- Samples at a rate of 980 Hz (above nyquist)
- Sampling process takes 1.12 seconds per string
- 1024 samples in each iteration
Microcontroller - Signal Processing

- FFTW library
- Desired frequency identifier
- cent difference calculation
Tuning - Motor Selection

- Ideal Specifications
  - 36 in-lbs torque rating
  - Readily available
  - Inexpensive
  - Lightweight
  - Small Footprint
● Uses test based mathematical model
● Encoder
● 8 halfstep window centered around standard tuning
Modifications:
- 4N33 isolators
- Resistor values for isolators
- Logic level FETs
- Pull-up/down resistor values
- Base resistor values
Tuning - H-Bridge
Tuning - Motor Mounts

- Weaver Rail
- Wood
- Aluminum Plate
Tuning - Pickup Mount
Power Supply

- Motor powered by DC power supply
  - 8+ Amps
  - 8 Volts Maximum
- BeagleBone Black plugged into outlet
  - 5V, 1 Amp regulator
- Exploring feasible batteries
Feasibility

- Concept is feasible
- Commercial implementation would become costly
  - Motors
  - Batteries
Thank You!