

Preliminary Design Review

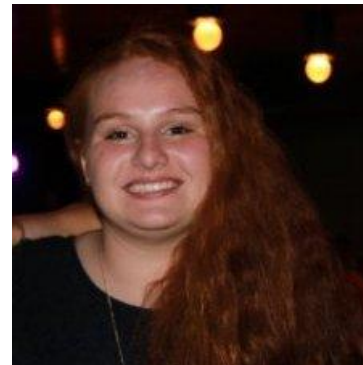
Team QuickTab
October 19, 2016



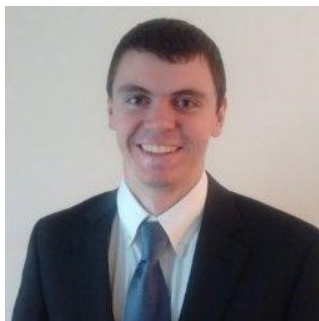
QuickTab (Intuitive Tablature Generation)



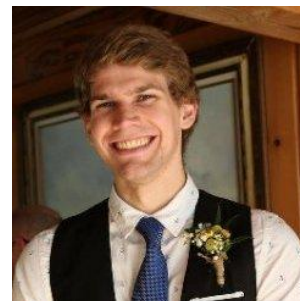
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Teaching/Learning Guitar for the First Time



Taking the first step to learning the guitar can be daunting for a number of reasons:

- Beginners do not read musical notation
- Professional lessons are costly
- Interpreting verbal instructions can be a challenge

Learning with Tablature

As an alternative to contemporary styles of musical notation such as sheet music, our project utilizes a system of notation known as tablature.

The image displays a musical score for a guitar piece in 4/4 time. The top staff is a treble clef staff with a 4/4 time signature. The melody consists of two measures. The first measure contains four eighth notes: G4 (with a sharp), A4, B4, and C5. The second measure contains four eighth notes: D5 (with a sharp), E5, F5 (with a sharp), and G5. The bottom staff is a guitar tablature staff with six lines. The letters 'T', 'A', and 'B' are stacked vertically on the left side of the staff. The first measure of the tablature shows the sequence of fret numbers: 1-2-3-4 on the first line, 1-2-3-4 on the second line, and 1-2-3-4 on the third line. The second measure shows the sequence: 1-2-3-4 on the first line, 1-2-3-4 on the second line, and 1-2-3-4 on the third line. A double bar line is at the end of the second measure.

Insufficient Methods of Transcription

STAIRWAY TO HEAVEN
Led Zeppelin
Led Zeppelin IV
Words & Music by Jimmy Page & Robert Plant

Standard tuning
Slowly ♩ = 72

[A] Intro
Am Amin maj9 Am7 D/F# Fmaj7 G Am

let ring throughout

5 7 5 7 8 5 8 2 3 2 0 1 2 1 0 1 2 0 1 1 0 2 2 2 2 2 0 0 0 0 3 8 7

- No Pre-existing Technology
 - Currently, there is no method to transcribe live acoustic performances directly to tablature

- Current Standard Method
 - Manually enter in every note
 - Transcribe sheet music to tablature notation

Project QuickTab

- A hassle-free notation process
- Designed to transcribe notation directly from acoustic stimulation
- Suitable for all levels of proficiency
- Can be used as a teaching aid

Effect on the Musical Community

- Will make tablature creation accessible to more than simply the computer literate
- Empowers guitar teachers with the ability to generate visual guides for their students
- Simply put, QuickTab circumnavigates the tedious process of manual transcription by collecting rhythms and pitches as they are played

Previous Designs

- Laser Pitch Detector

- *M3i Technologies*
- Uses lasers to determine string length
i.e. current fret being played
- Alternative way to record music
- Set for commercial release in 2012
(*never released*)



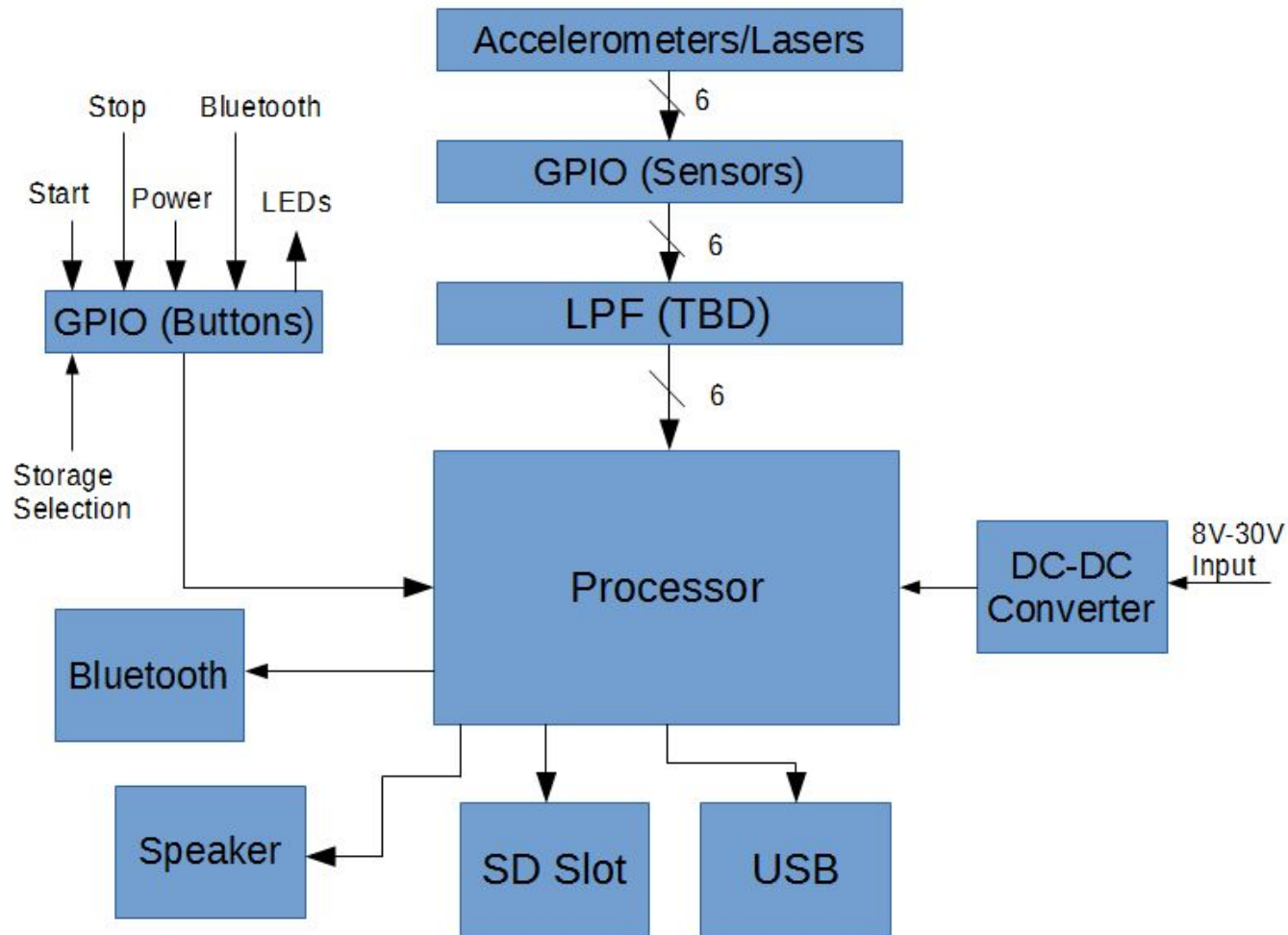
- AutoTabber

- *SDP15*
- Used 6 pickups to detect signal from each string
- Ultimately unsuccessful

Our Solution

- Six Individual Sensors attached to strings
 - Attached to the bridge of the guitar
 - Sensors measure frequency in which strings vibrate
 - Data received will be converted into tablature based off of the frequency
- Storage and Recording
 - Will allow for various modes of saving your songs, either via Bluetooth or USB or onto an SD Card
- User Interface
 - Easy-to-use UI on the device
 - Buttons to both start/stop a recording and to choose a recording method

Block Diagram



Input and Output Specifications

- Determine String & Fret
 - By interpreting the frequency received by individual accelerometers

- Uphold Recording Fidelity
 - Digitally process and/or filter the signal to maintain consistency with original notes and rhythms

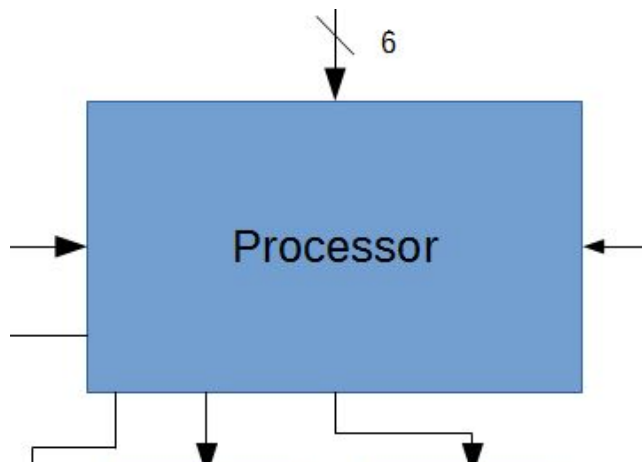
- Transcribe
 - Recorded Signals to Visible Tablature

The Code

- Design Goals
 - Efficiently parse received signals into frequencies while maintaining accurate rhythms
 - Transcribe parsed signals into a standard tablature filetype (*PDF, GPX*)
 - Concessions must be made for imperfect timing
 - Identify notes & chords (*optional: slides, hammer-ons, pull-offs*)

Raspberry Pi

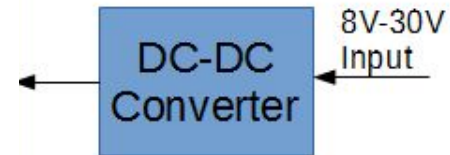
- Implementation must be able to comply with the constraints of the Raspberry Pi 3
 - 1.2GHz 64bit Quad Core Processor
 - 1GB RAM
 - 40pin extended GPIO



Power

- Requirements

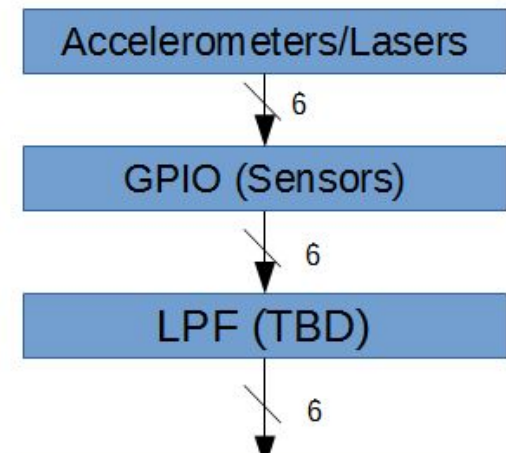
- Input of 8V – 30V as designated by the Raspberry Pi
- Device must be lightweight, long lasting and power efficient (*located on strap*)
- Stable power source (PCB Component)
- Power Consumption will determine if processing is done on or off board



Sensors

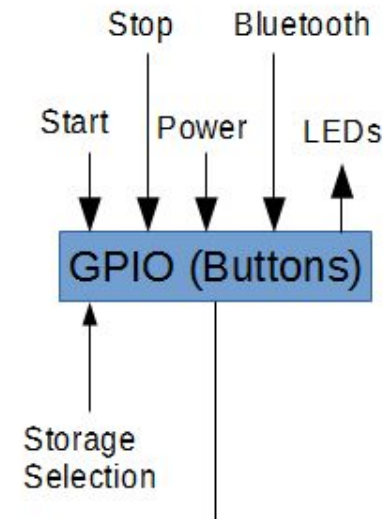
■ Requirements

- 6 Sensors that are able to accurately relay the frequency of the strings when played
- Lightweight, minimally affects the sound and feel of the guitar, guitar should be easily tunable once sensors attached
- Easily attachable to the guitar
- Able to transmit data faster than new input is received



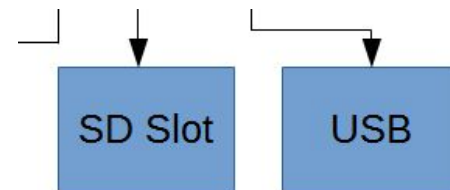
User Interface

- Requirements
 - Easy to use
 - Allow the user to start/stop recording
 - Switch between recording modes
- Implementation
 - GPIO of the Raspberry Pi
 - Buttons and LEDs on the device to display current selection
 - Audible feedback on when recording has started/stopped
 - Metronome & Calibration (*stretch goals*)



Modes of Storage and Transmission

- Requirements
 - Hassle free use for each method
 - Data output is the same
- Implementation
 - Bluetooth Integration
 - SD Card
 - USB Connection to PC



Proposed MDR Deliverables

- Confirm sensor type
- Ability to record one string's rhythms and notes
- Verify timing and establish metrics for delay analysis
- Observe power consumption

Thank You

Questions?