

Autonomous Guitar (Interdisciplinary)

ECE SD1 Group 30 / CS SD1 Group 42

- Pedro Contipelli CS
- Blake Cannoe CpE
- Ethan Partidas CpE
- Jonathan Catala EE
- Kyle Walker EE

No customers, self-sponsored student project

Objective

Our goal for this project is to modify a guitar with electronics to be able to play itself.

The motivation for this project was an idea to bridge two very different fields: engineering and music, in order to create an autonomous system that is able to produce a work of art. We have seen and taken inspiration from videos on YouTube of similar projects:

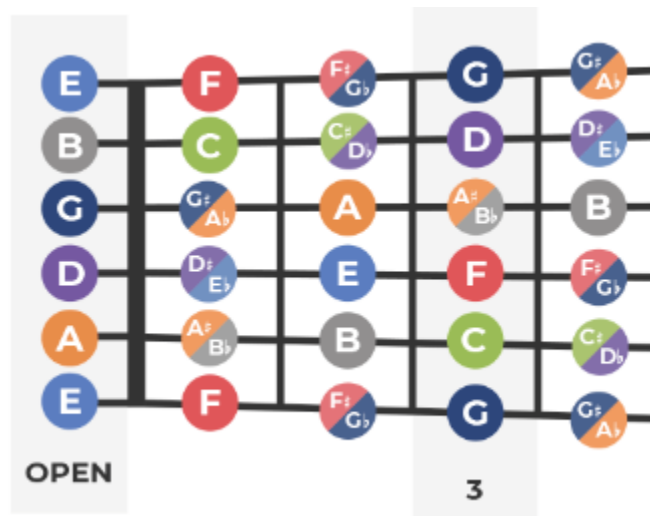
[▶ pirates of the Caribbean\(guitar-robot\)](#) [▶ Little Talks Guitar Cover by Lego Mindstorms EV3](#)

The design would be able to take in MIDI files and play the notes on the guitar using separate mechanisms for strumming and pressing select strings against frets. It would be lightweight and maintain the general form factor of the guitar (i.e, fits closely to the body).

The design would ideally be portable, and thus it would be powered by portable batteries. It should be responsive enough to accurately replicate the provided MIDI file compositions with comparable to - if not exceeding - the abilities of the average learnt guitar player.

Not only should this design be lightweight and portable, an issue with similar concepts is the price and size. They are typically not an attachment for a guitar and are more commonly an entire unit within the guitar. They are also extremely expensive with some models going for up to \$1,100. Our goal for this project is to bring this idea to reality for significantly cheaper.

Requirements/Specifications



Standards (standard protocols/file formats, etc)

- MIDI (Musical Instrument Digital Interface)
- [Standard tuning on Acoustic Guitar](#)
- Power supply conforms to standard market battery capacity & output (AA, AAA, 7 volt, etc.)
- Standard Microcontroller communication protocols (UART, SPI, I2C, etc.)

Requirements

- Able to take any given MIDI file and play it on the guitar
- Plays all notes between E2 and G#4 (29 notes, 1 duplicate, shown in figure)
- Can play all 6 strings independently
- Can press on any fret with a motor attached
- Can press on multiple frets at once with motors attached
- Can play multiple strings at once
- Frets & strumming using motors
- Must be able to play at least a 3 minute song

Constraints

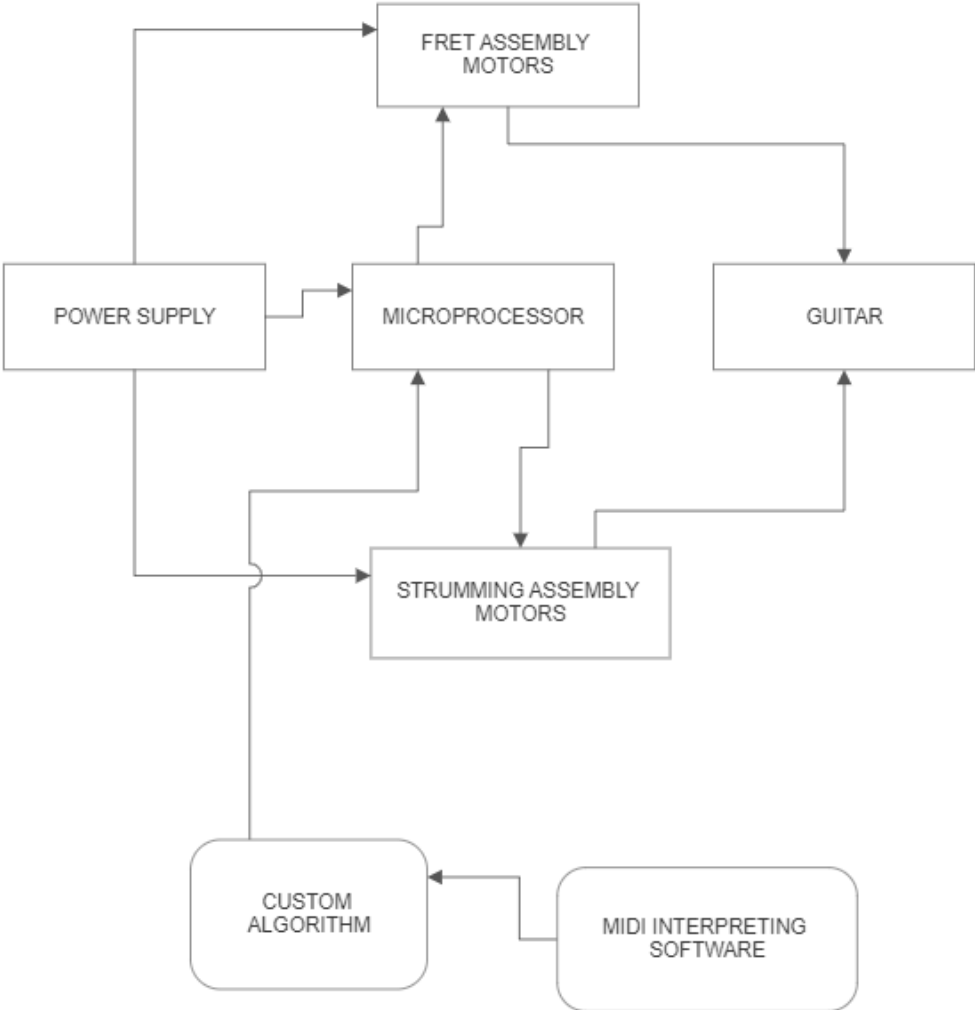
- Press strings with maximum force of 3N
- Control volume range: able to hit strings softly or with more force
 - Minimum fretting force of 3N
 - Maximum fretting force of 5N
- Electrical components weigh less than 3 lbs(?) Assembly
- Battery weigh less than 2 lbs
- Power consumed less than 9 W
- Must be battery powered

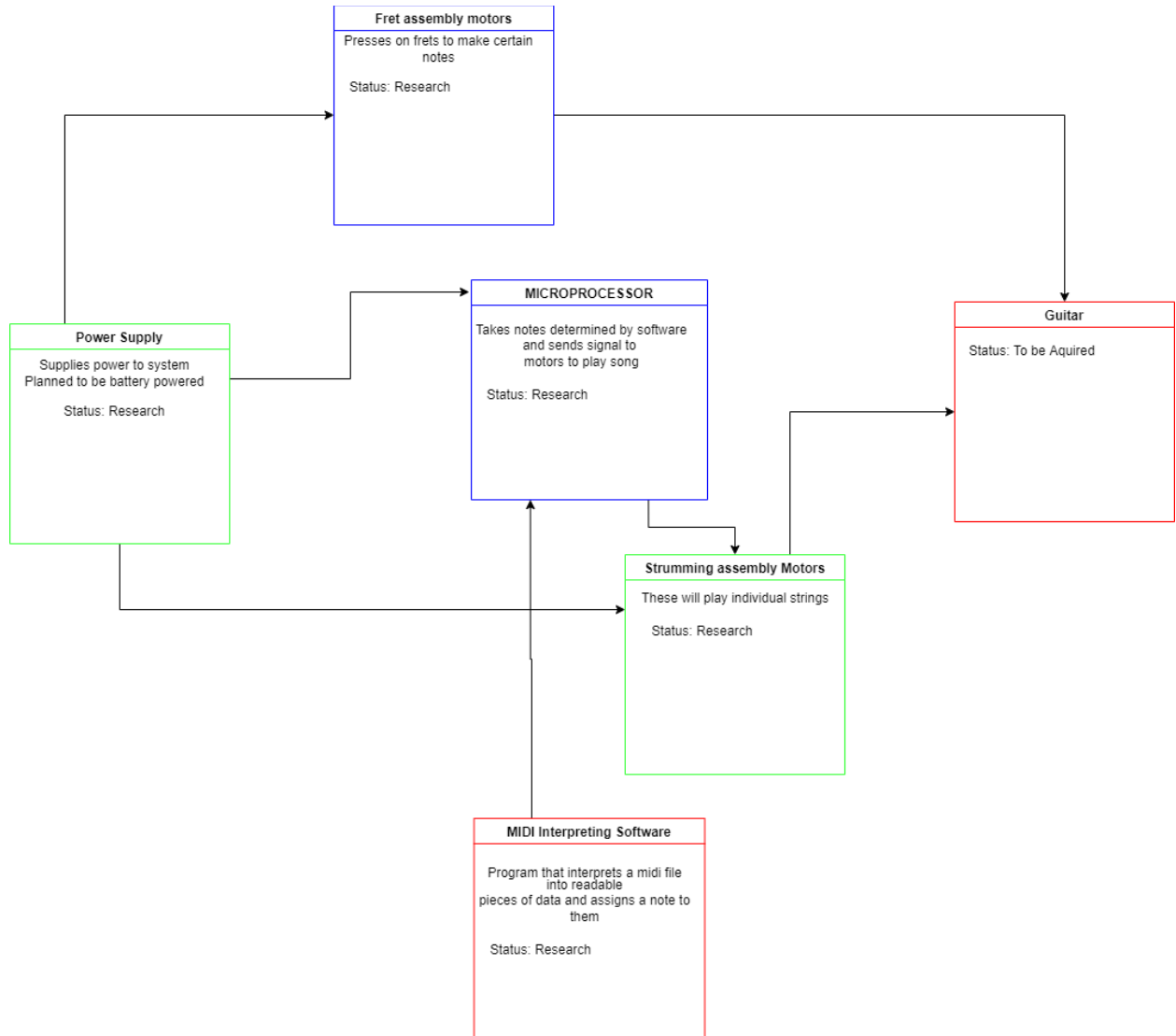
Specifications

- Acoustic Guitar
- MIDI File Size < 50 KB
- Microprocessor code written in C, high level algorithm Python
- Autodesk EAGLE for PCB design

Block Diagram

<https://cloud.smartdraw.com/share.aspx/?pubDocShare=8B65F2B4E34D85E3C13EEA4ADD792F67905>





Green: EE
 Blue: CpE
 Red: CS

Hardware: Power Supply -> Microprocessor -> Motors -> Guitar
 Software: MIDI interpreter -> Custom algorithm decides which strings/frets to play notes on

Workload Distribution

Pedro (CS): high level algorithm

CpE: microprocessor coding, design

EE: setup, electronics, wiring, hardware, etc

Budget/Financing

Used Guitar: < \$30

Microprocessor: \$20

Misc. Electrical components: \$5 to \$10

Motors for frets and strumming: \$60

Milestones

SD1

September 30th: D&C V2 submitted

November 4th: 60 page report submitted

November 18th: 100 page report submitted

December 6th: Documentation & schematic complete. Parts ordered.

SD2

Quarter through term: Project Prototyped

Halfway through term: Prototype refined / Requirements revised

Three-quarters through term: Final Prototype, initial presentation drawn up

End of SD2: Project built, ready to present