Medical Device Engineering

Exoskeleton Project

Hip Flexion Group

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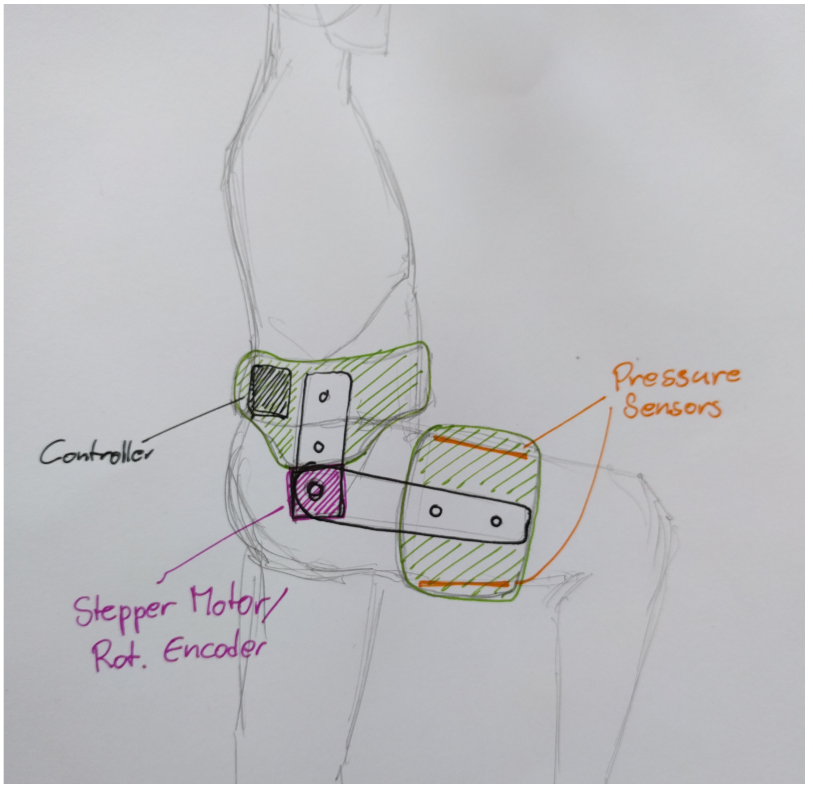
Outline

- Overview of Planned Design
- Current Status and TODOs:
  - Pressure Sensors
  - Motor Controller
  - Rotary Encoder
  - Mechanical Design
- Open Questions

Planned Design

- Orthosis as Base
- Direct Drive with Stepper
- First Version: only flexion
- Pressure sensors for intended movement
- Rotary encoder for real hip angle



Pressure Sensor – Status

- FSR 402/406
- Code for reading values is complete
  - Pressure in 4 categories
  - Reading every 0.1sec

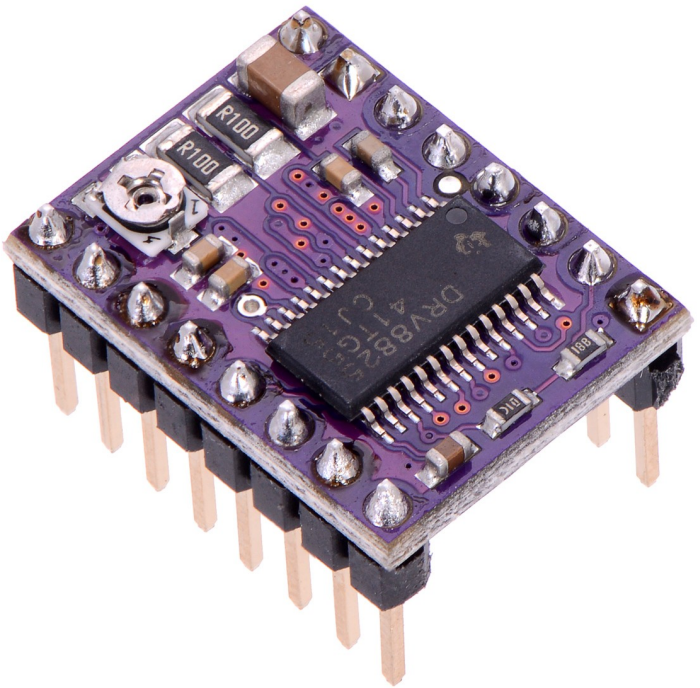
Pressure Sensor – Goals

- Find the optimal placement on orthosis
- Test if pressure is readable while walking
- Sew pocket for sensors, wiring

Stepper Motor Controller – Status

- DRV8825
- currently testing library

  https://github.com/laurb9/StepperDriver
- Issues with micro-stepping and changing speed during movement
- New stepper motor should arrive soon (?)



Stepper Motor Controller – Goals

- Reliably control motor speed
- Link motor with rotary encoder, determine current angle

Rotary Encoder

- HEDM 5500 B14
- According to documentation 1000 CPR (counts per revolution)
- To determine the angular position, theoretically angle=count*(360/1000)

Rotary Encoder – Status

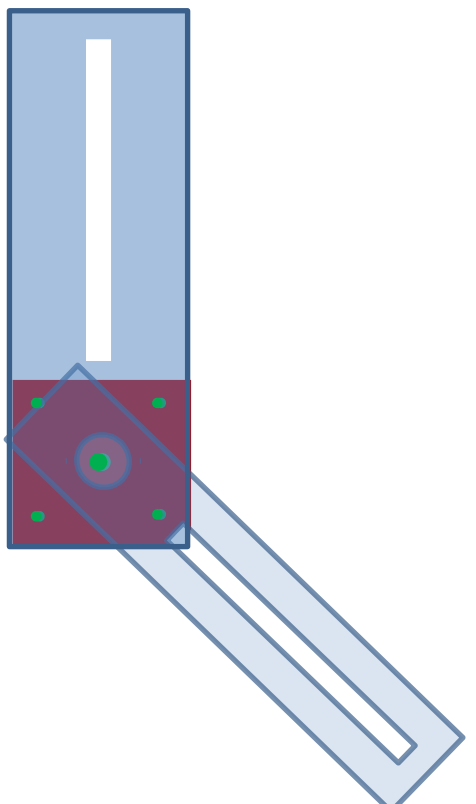
- Currently able to output a count for each step of the encoder, including direction (clockwise = +; anticlockwise = -)
- Unable to display angle yet as shaft is not fixed properly, and count is therefore not accurate
- Next step is to fix the hardware so that output is accurate
- Then counts per revolution may be determined, and code can be adjusted easily to determine angle

Rotary Encoder – Goals

- Fix encoder shaft and determine counts per revolution
- Integrate encoder with motor
- Add in switch so that encoder angle/count is set to zero when pressed

Mechanical Design – Status

- Plan: Replace joint and lever of orthoses with a new structure
- Prototype: Laser-cut acrylic
- To Do:
  - Lasercut parts designed with CATIA
  - Verify proof of concept



Open Questions

- Controller Design: Integrating force sensors to determine motor speed
- Configuration of parameters for joint movement (stopping angles, speed)
- Integration with other groups' parts:
  - Power supply
  - Code fusion?
  - Communication?