

# HouseAUTO

House Automation & Multimodal Input Devices for IOT Infrastructure

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Motivation

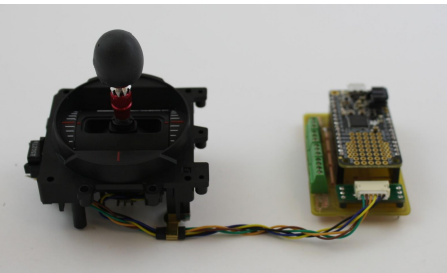
# Need Kowner: Owen Kent

- Current joystick:
  - Cannot properly click, right-click or drag items
  - Permanently mounted on wheelchair (only joystick)
- Door operates via RFID system and Press-Plate Button near door
  - Very buggy
  - Must hit button to let in people without keys
- Common house appliances
  - No way to control the lights in his own room
  - Can not talk to other devices, such as popcorn maker

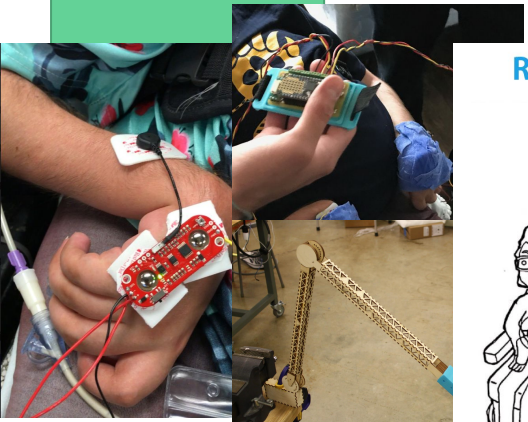
# Our Solution

- New input joystick device that can be used while prone in bed
- Tablet application that serves a hub to control devices around the house
- Two input sensors on the hands for right and left mouse click

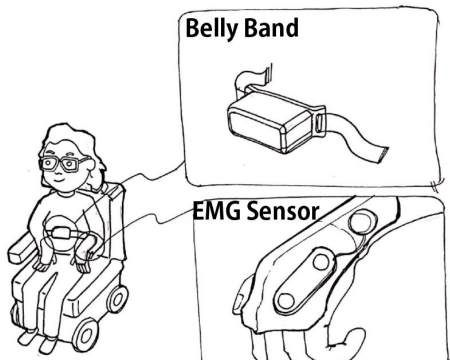
# Design Process



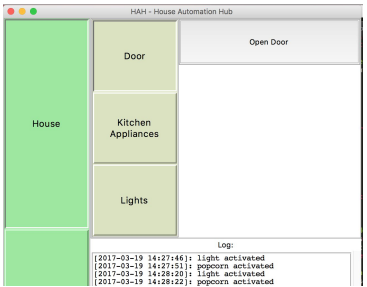
EMG + Joystick + Arm



RobOwen, EMG Controller

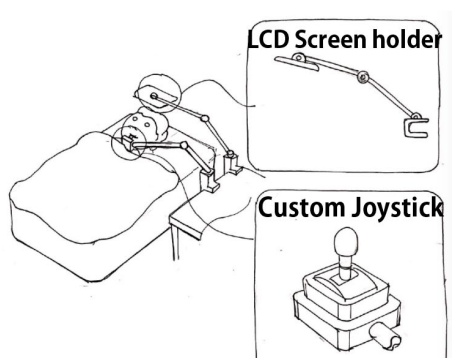


House Automation Hub (HAH)

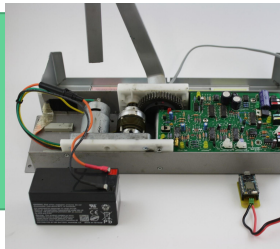


Node.js Server

RobOwen, Bed Controller



door



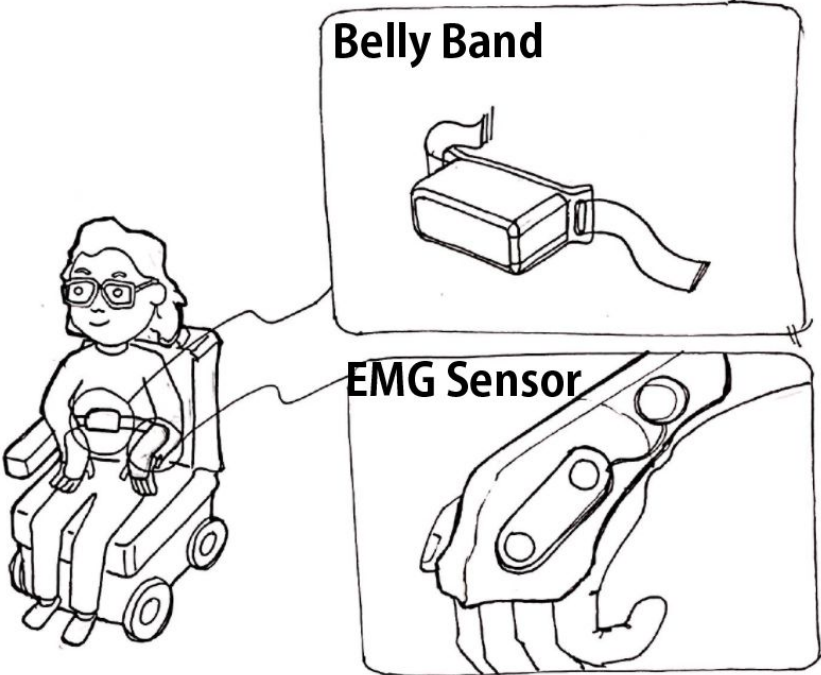
popcorn



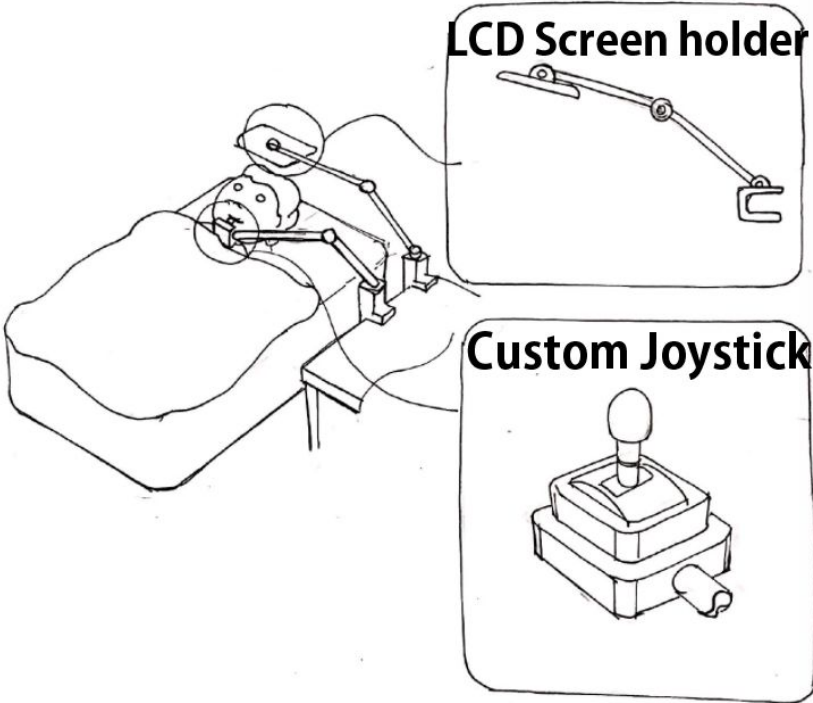
lights

... or any other appliance!

# RobOwen, EMG Controller

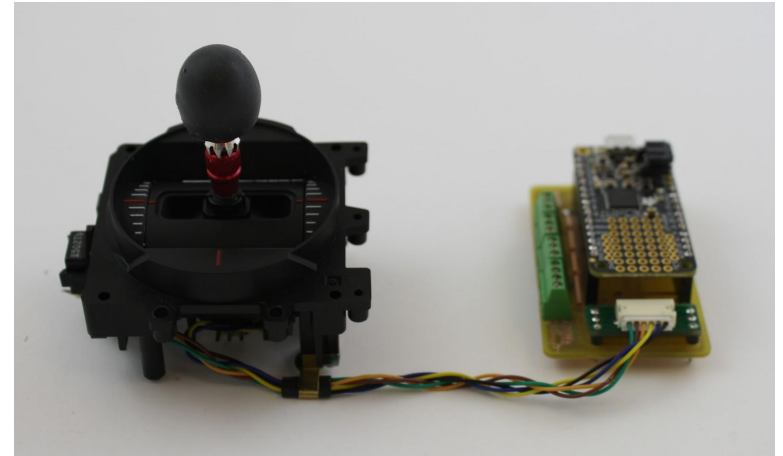
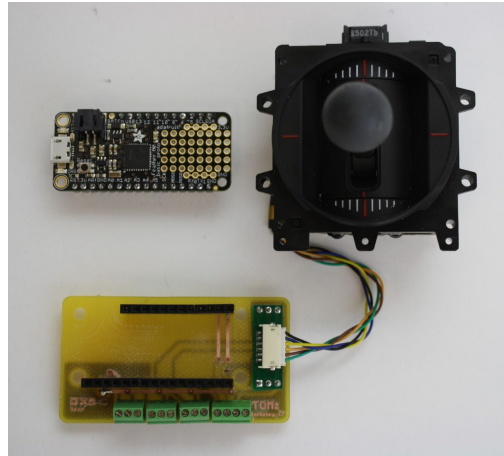
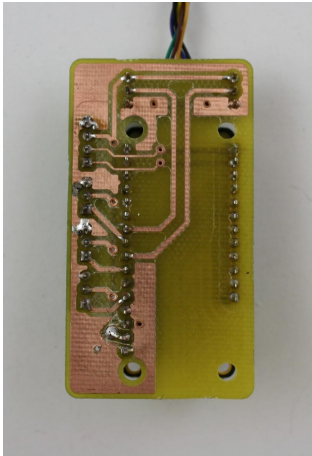
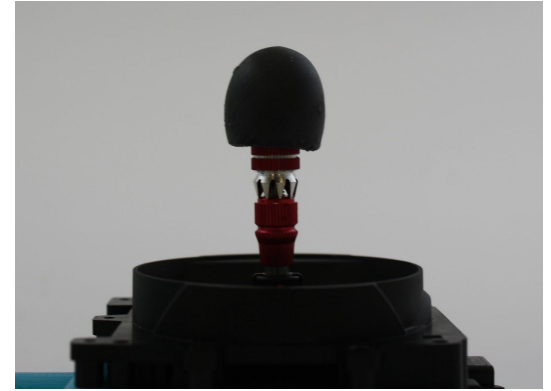


# RobOwen, Bed Controller



# New Input Device - Joystick

- Feather M0 MCU as USB mouse to any computer
- Analog Joystick for XY position
- Custom soft 3D printed SLA tip for comfort and grip
- Custom PCB

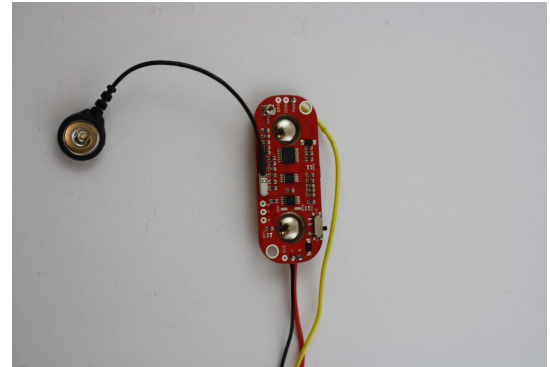
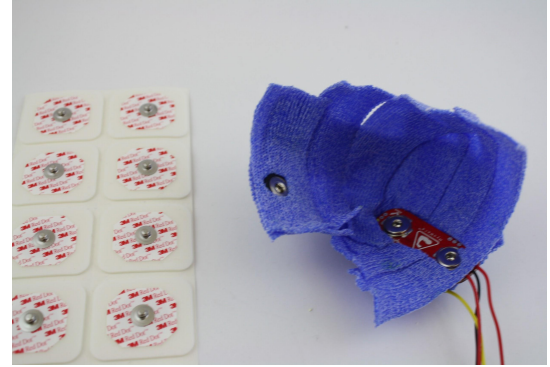
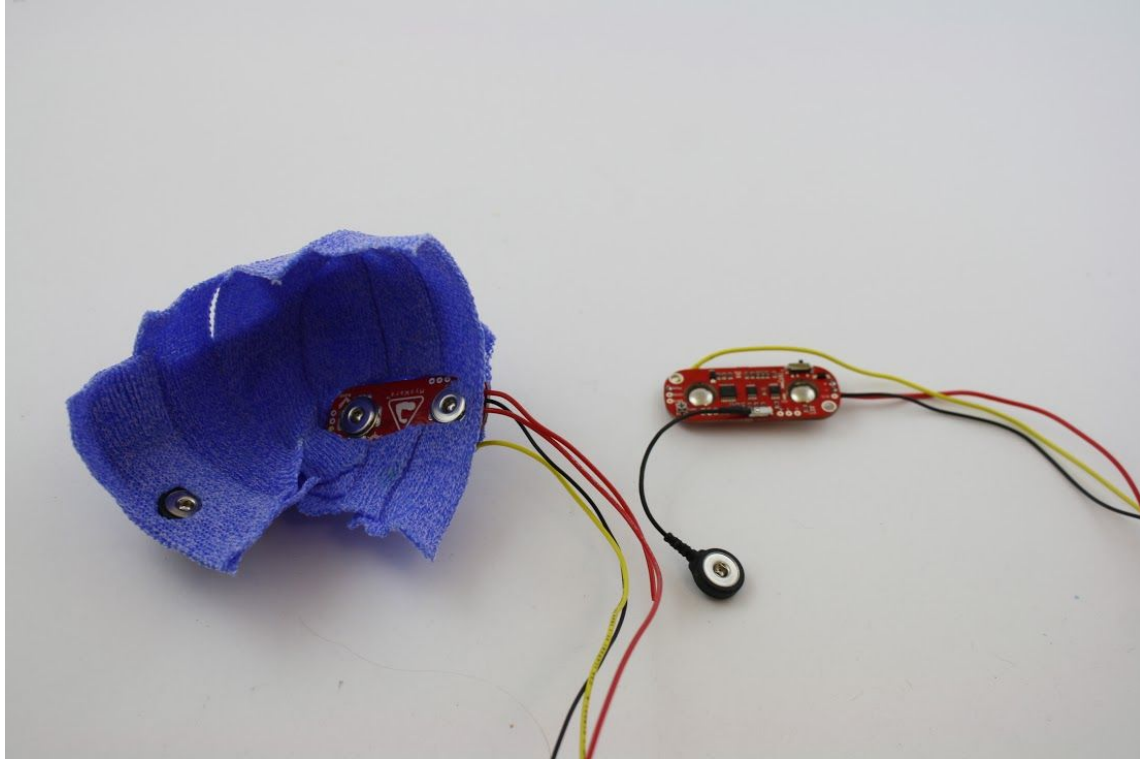




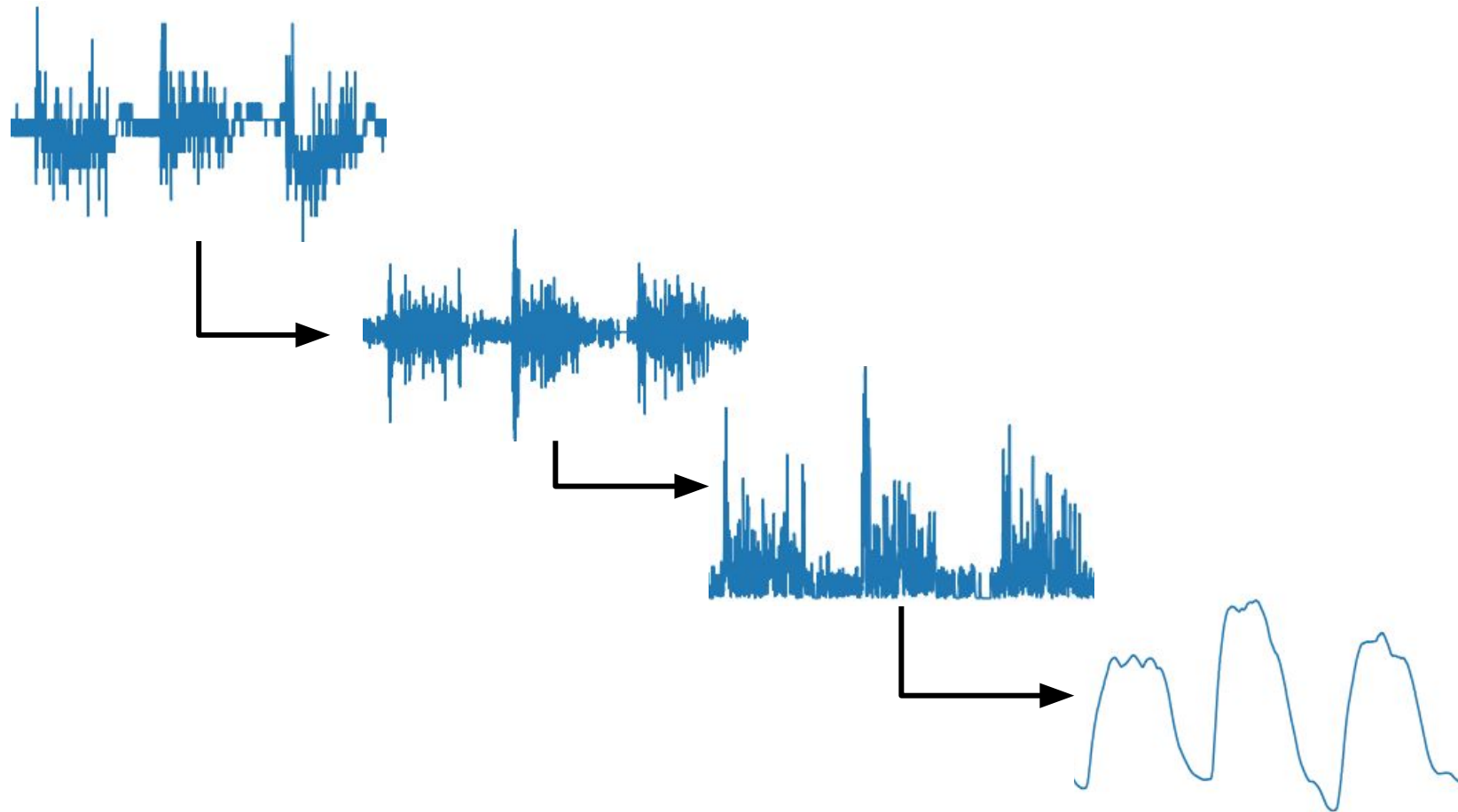
# New Input Device - EMG + Accelerometer

- Capture slight movement of hands and stomach
  - Muscle Rehabilitation
  - Intuitive Input
- Electromyographic (EMG) sensors on each hand for clicks
  - Right hand - right click
  - Left hand - left click/click and drag
  - Hold both hands for powering system on/off
- 3-axis accelerometer to detect voluntary stomach movements

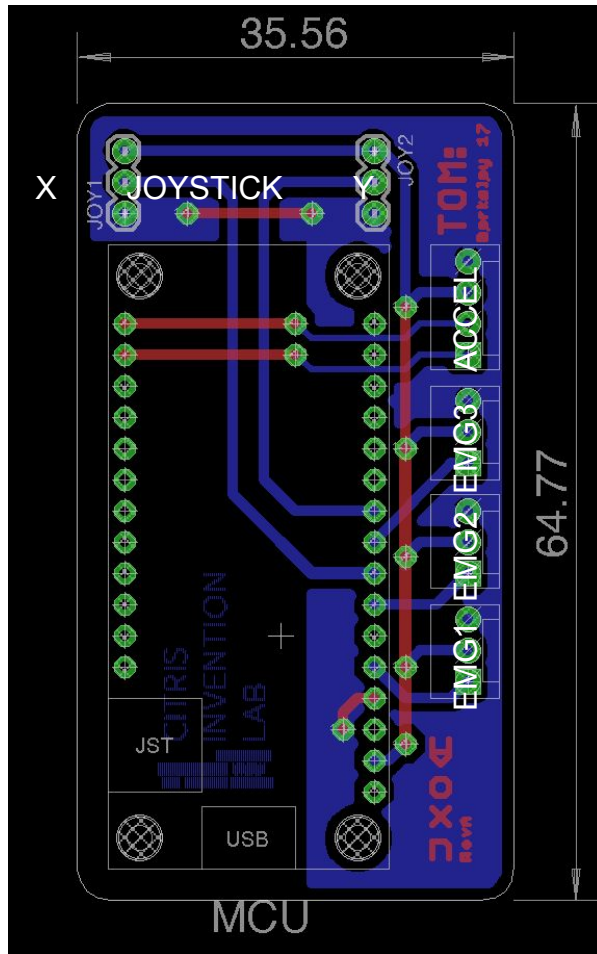
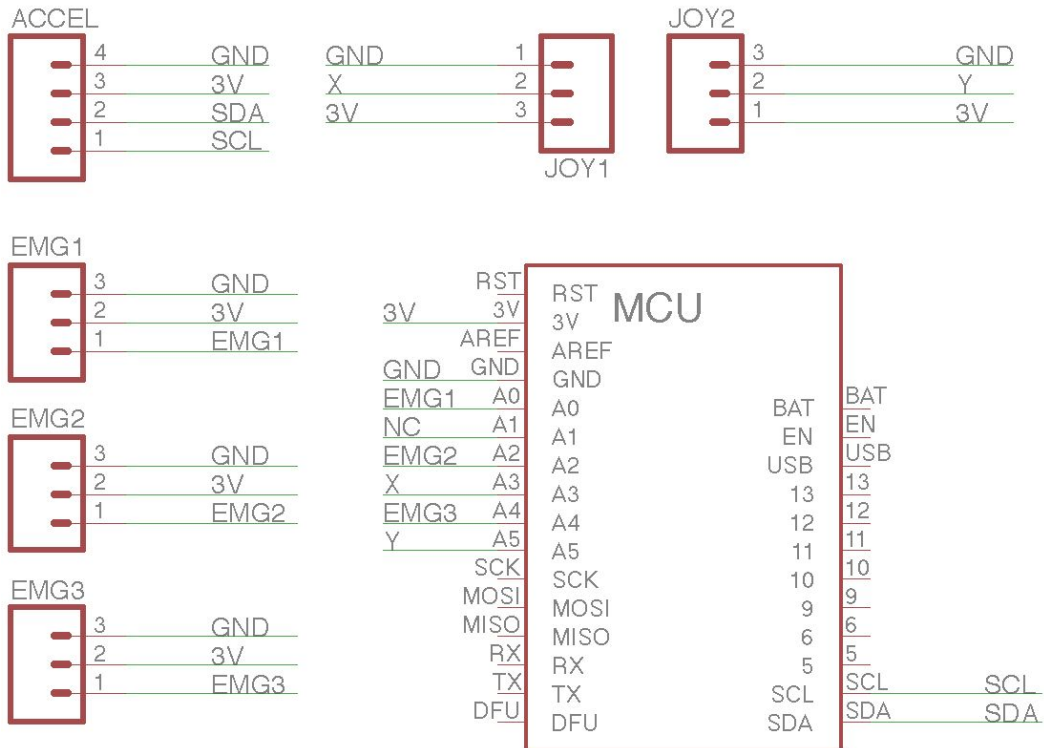
# New Input Device - EMG + Accelerometer



# EMG signal processing on board



# Axon Board



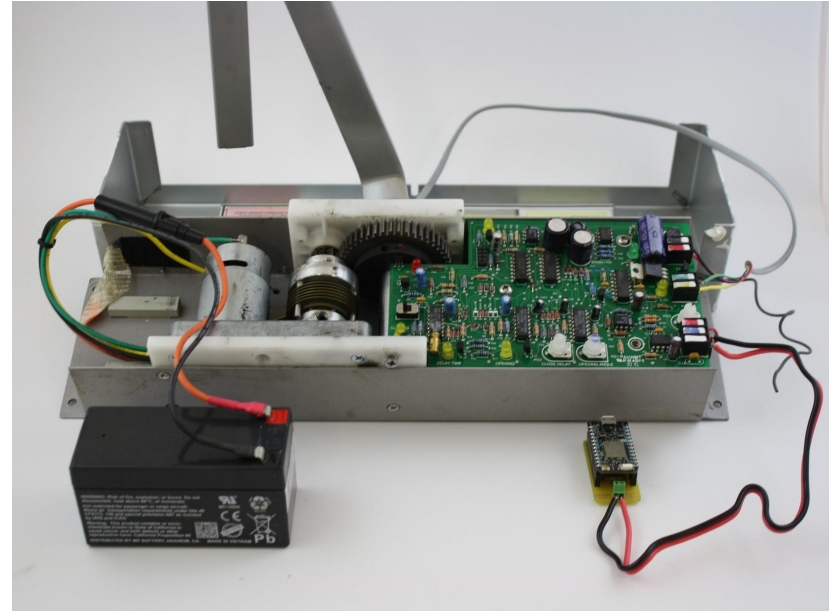
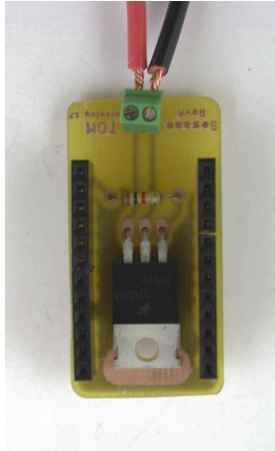
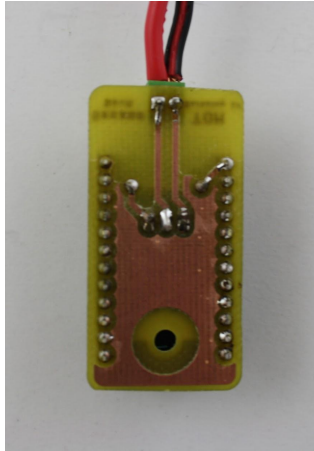
# Application + Server

- Cross-platform tablet application sends commands
- Local node.js server receives commands
- Server relays information to Particle Photon MCU (custom PCB)

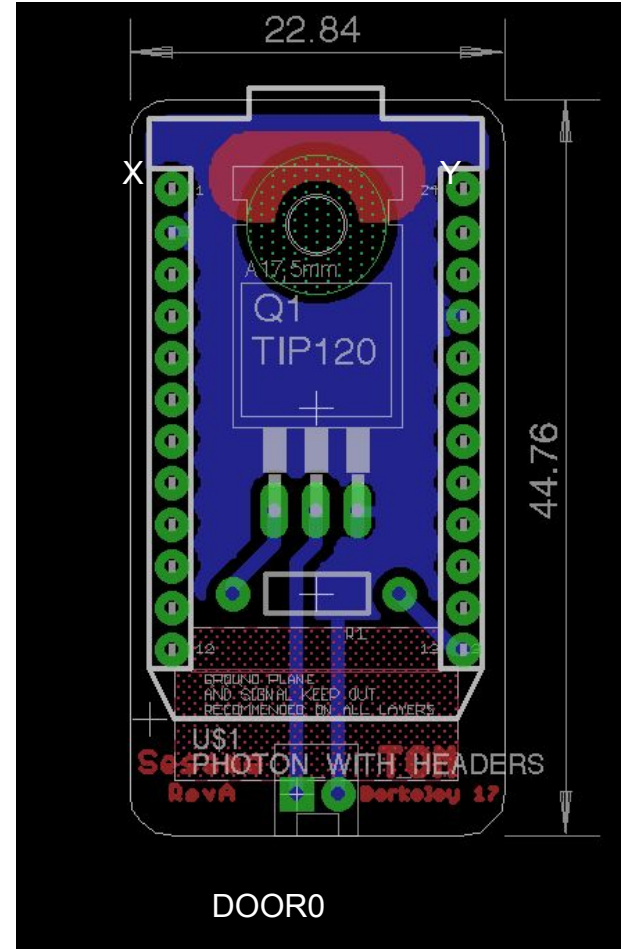
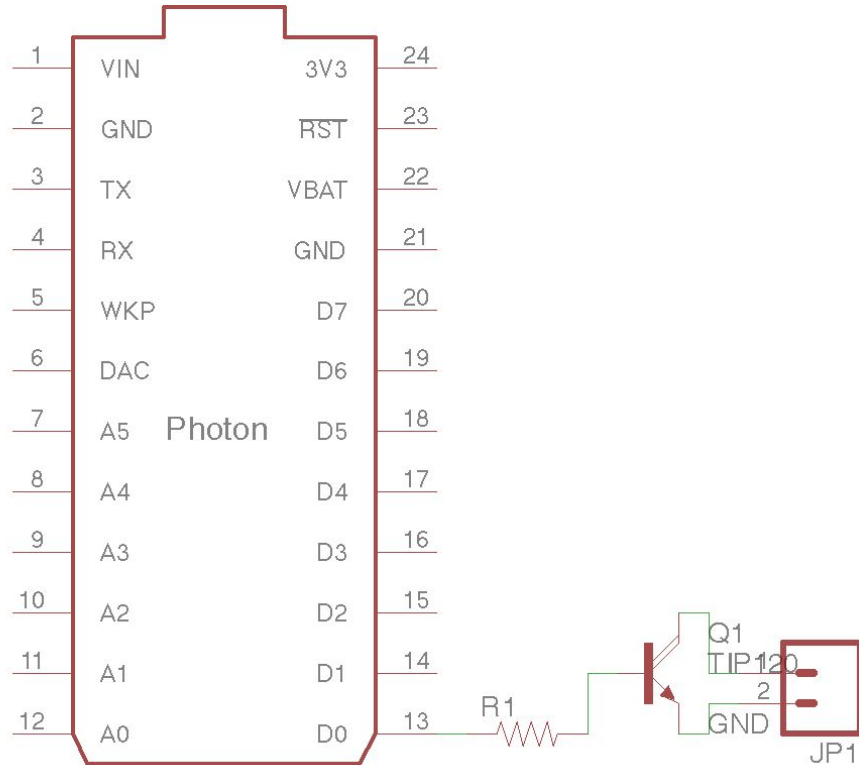


# Control of Devices

- Hacked Opensesame door motor
  - Graceful degradation
  - Much easier control of door position

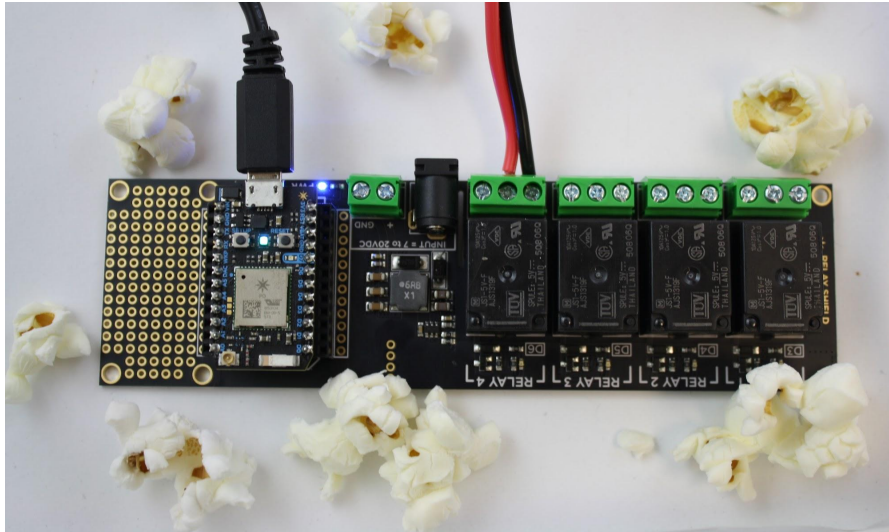


# Sesame Board



# Control of Devices

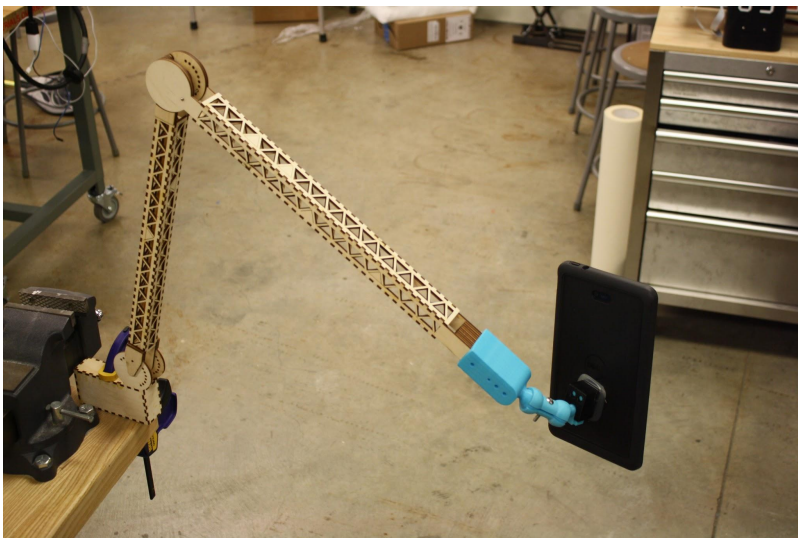
- Particle Photon relay board interfaces with household appliances



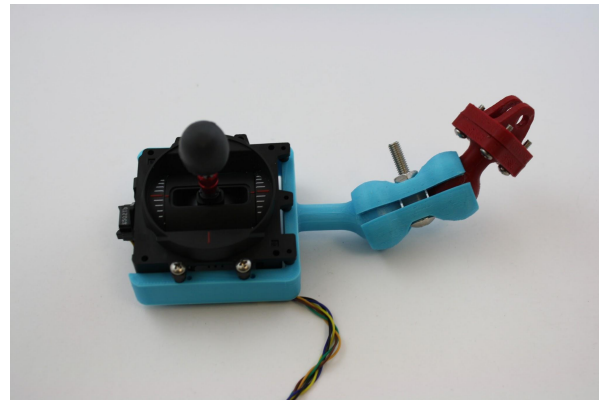
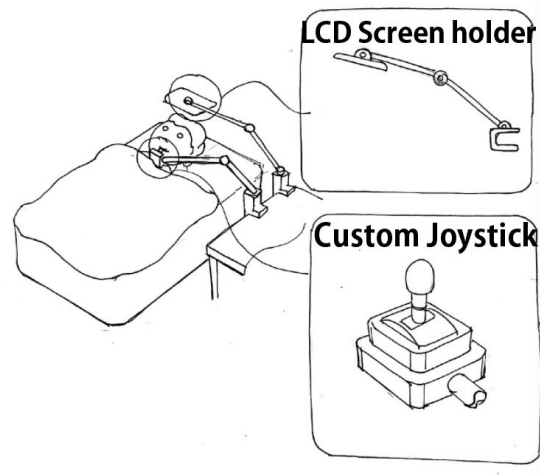


# Mechanical Mount Design

- Bedside mounts hold new joystick and tablet
  - Laser Cut and 3D printed fabrication (Fusion360)
  - Modular joints allow flexible placement

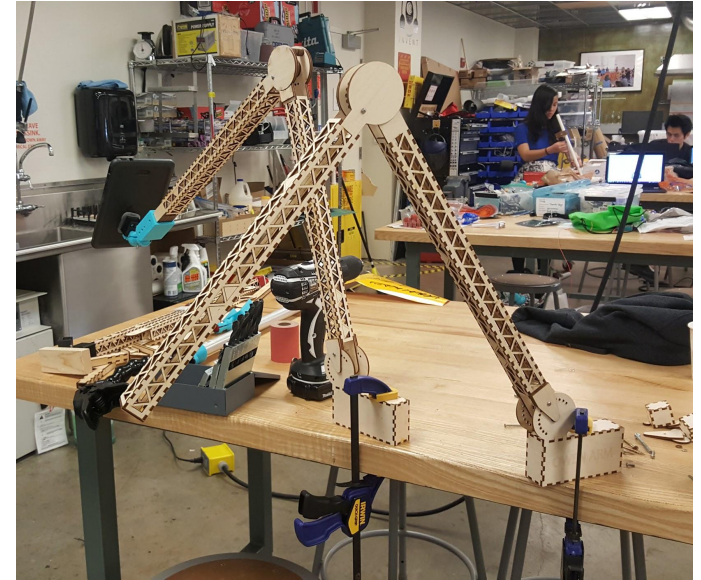
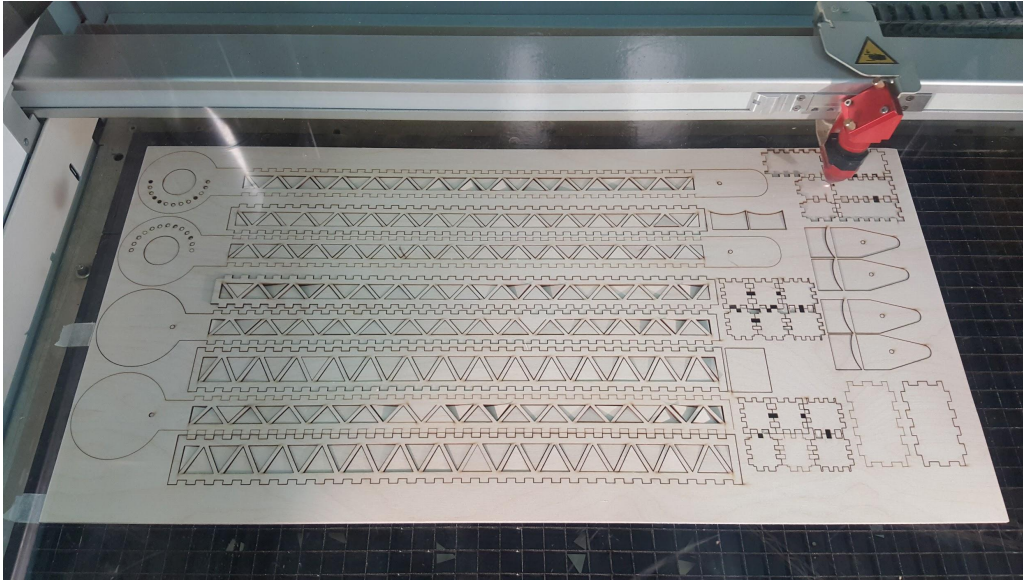


## RobOwen, Bed Controller

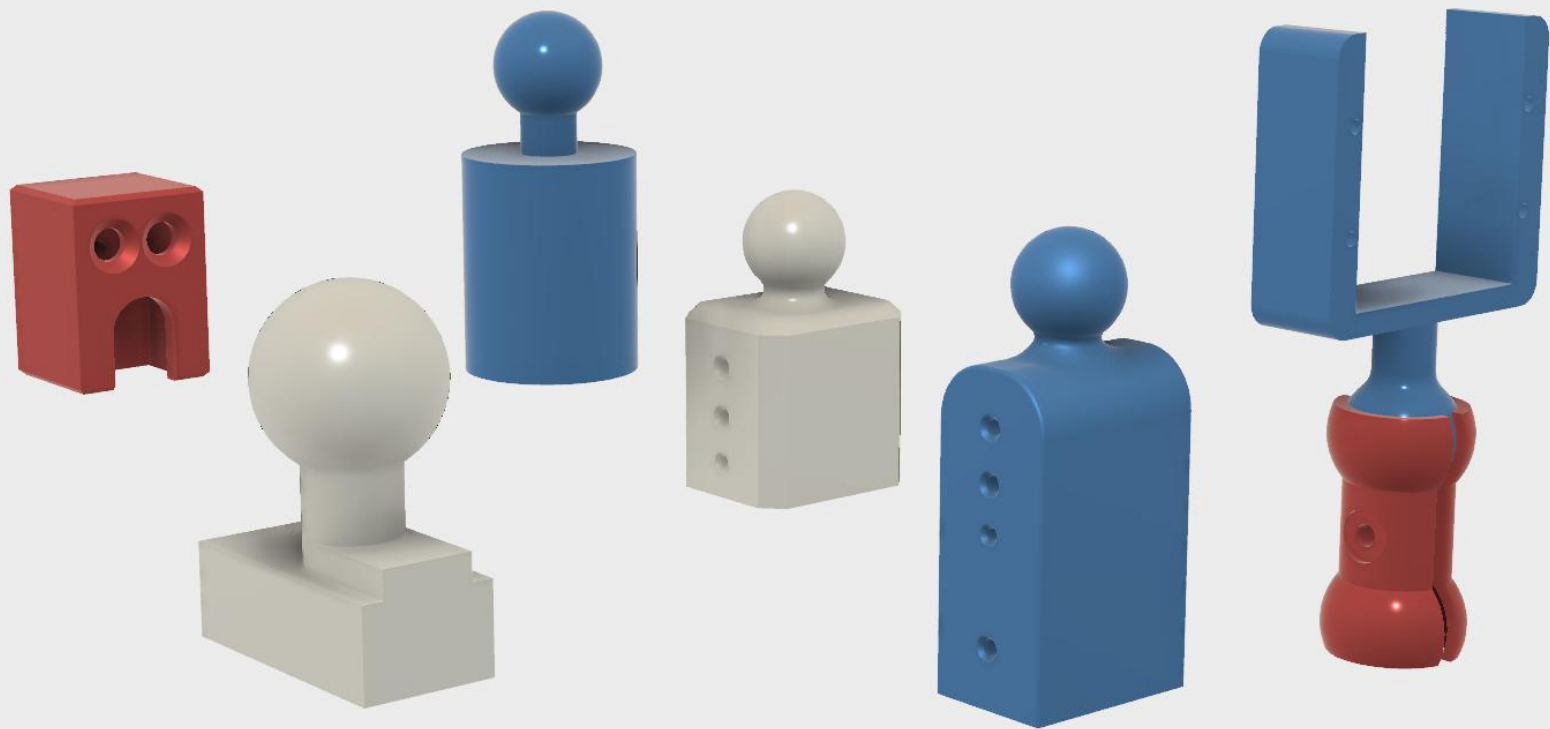


# Laser-cut arms:

one to hold a tablet; one to hold a joystick

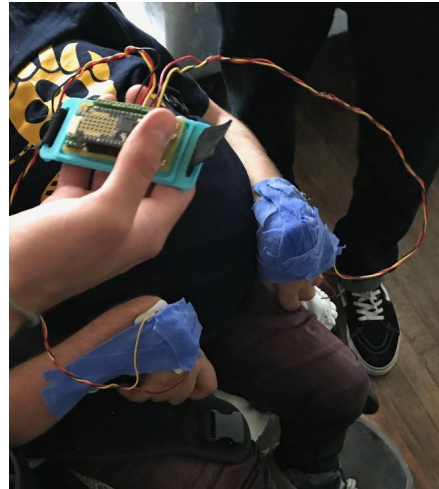
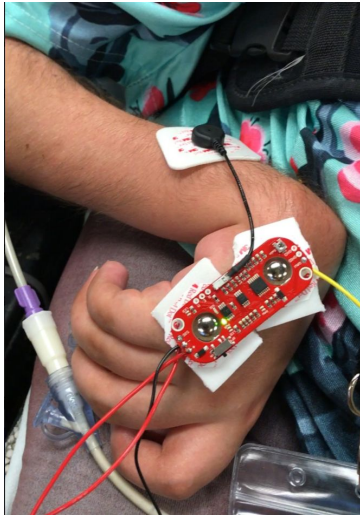


# Custom 3D-Printed Ball-Joints and Mounts

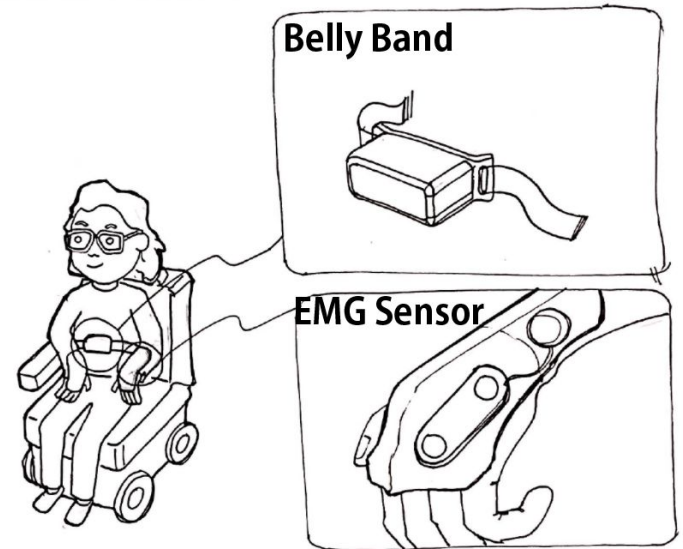


# Mechanical Mount Design

- EMG electrodes embedded in custom formed cast
- Fabric fo stomach accelerometer



## RobOwen, EMG Controller



Video / Photos / Demo