Implementing Force Sensing Technology

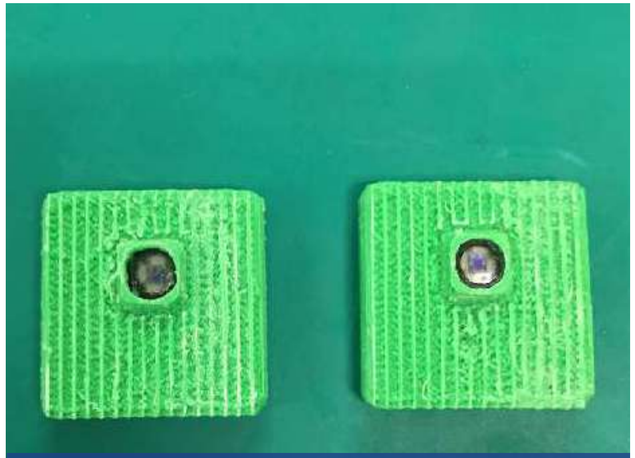
Delsys has identified an opportunity for growth by expanding their EMG product line to incorporate foot pressure mapping technology.

Trigno Avanti

The purpose of this project is to create a compressible shoe insole for monitoring foot pressure distribution that would support foot contact data alongside EMG + IMU data.

Sensor

The first prototype will consist of a mini 4 cell system composed of Honeywell sensors that use piezo-resistive technology in a silicone encapsulation.



Prototype

The ultimate product target is a manufacturable 64-cell pressure-sensitive, thin, reusable insert that connects to a single Trigno Avanti sensor. Two units would offer left and right foot pressure distribution in real-time.

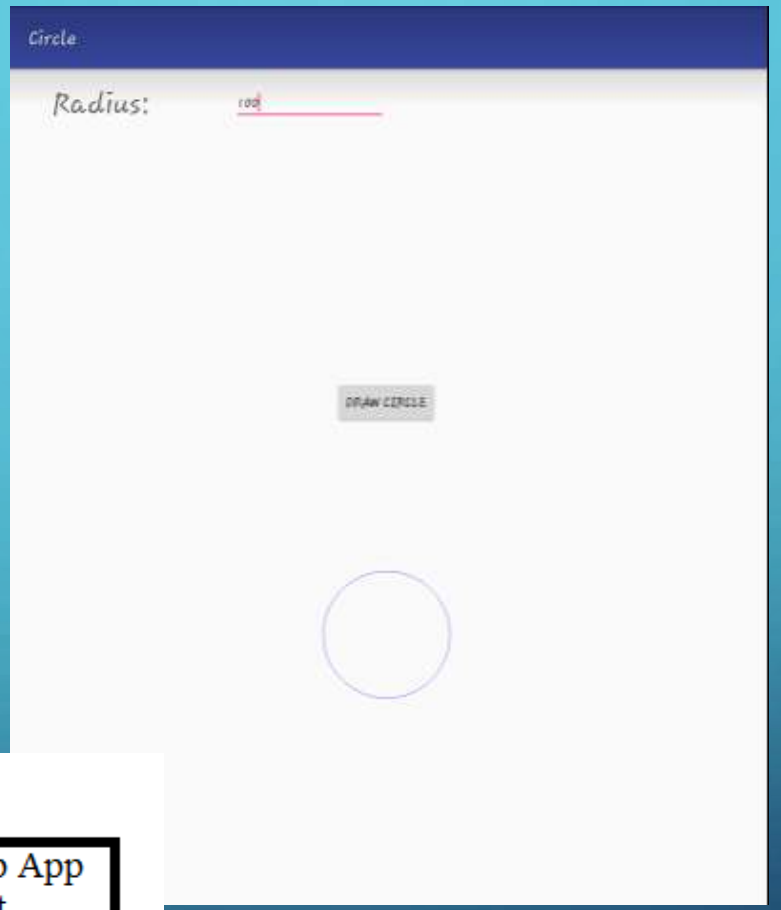
BIOFEEDBACK FOR EMOTIONAL DYSREGULATION OF ANGER

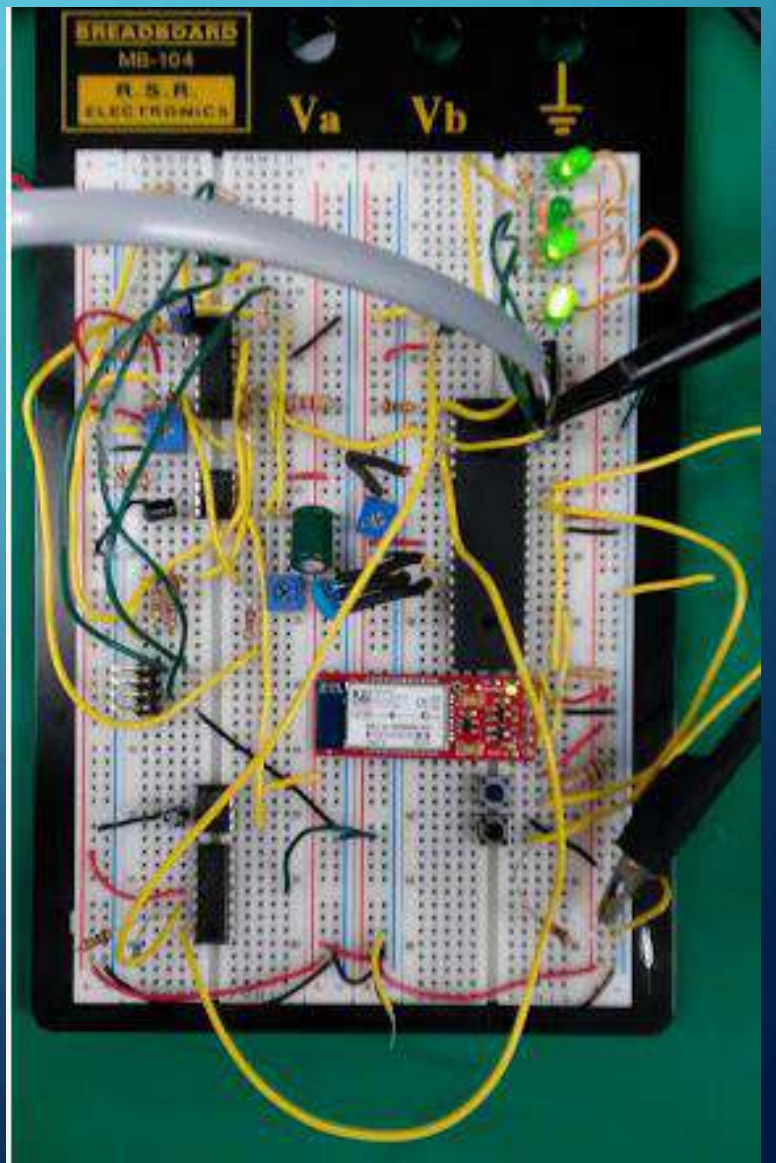
GROUP MEMBERS:

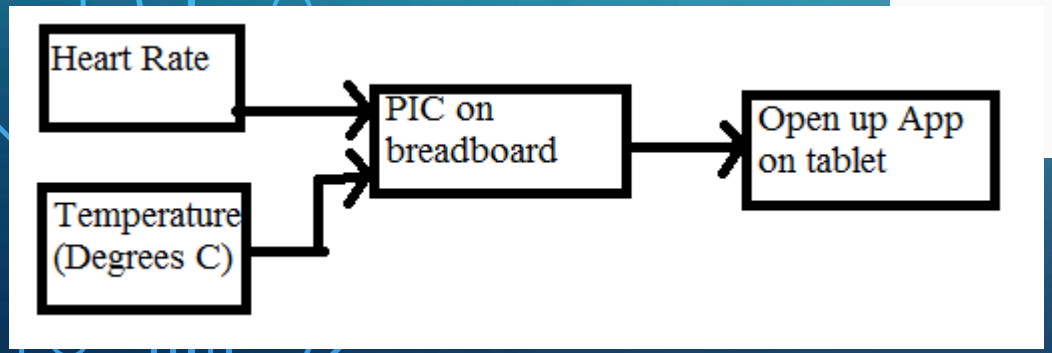
ZACHARY SILVEIRA

ELAINE JOYCE

SAMANTHA PROVENCHER

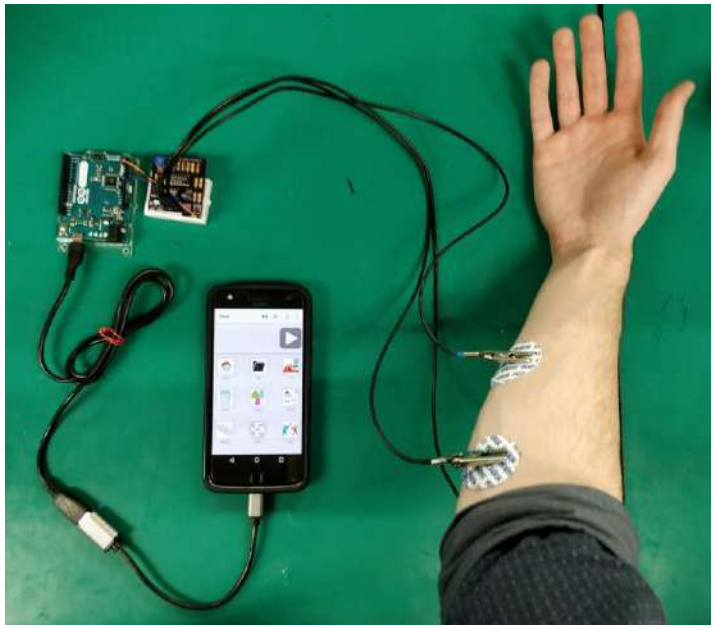




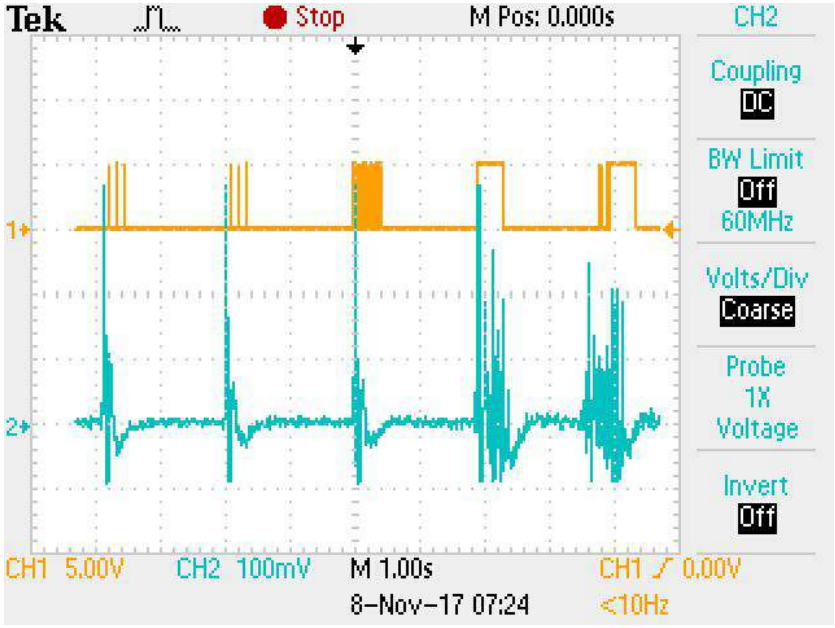


Alternative Augmented Communication

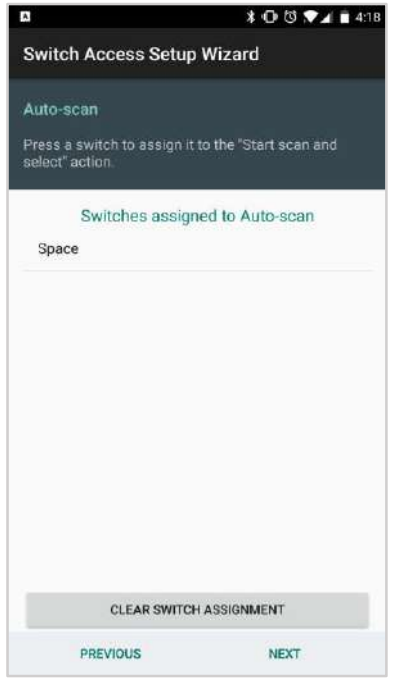
Communication solutions utilizing electromyographic sensors and Android Accessibility



Hardware Setup

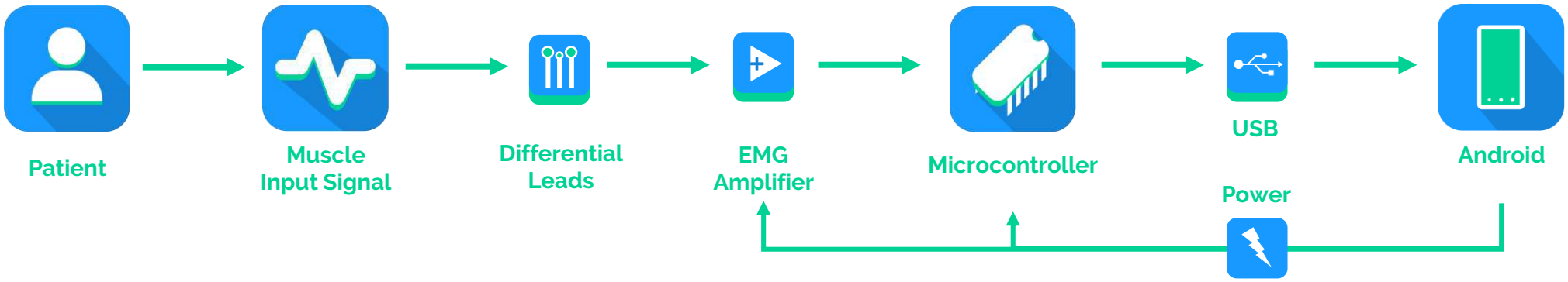


Scope – Channel 1 MOBD – Channel 2 EMG Signal



Android Accessibility

LetMeTalk



Josh Harper & Zach DiMartino

Model House for Assisted Living

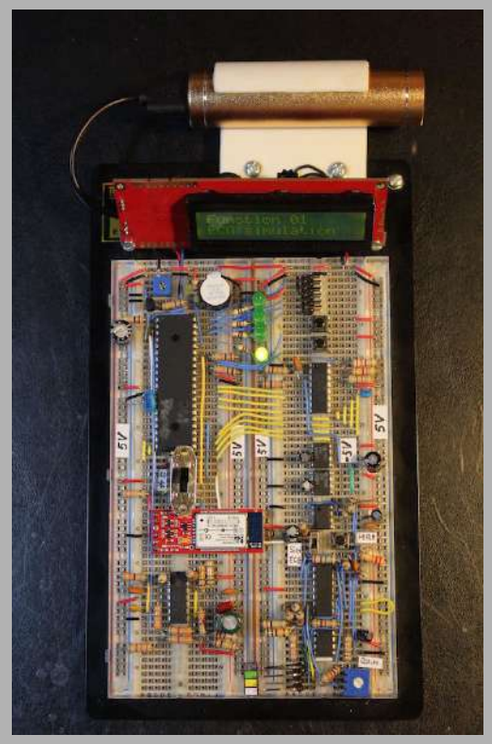
Amy Harmon, Ahmaad Randall, and Alexis Welch

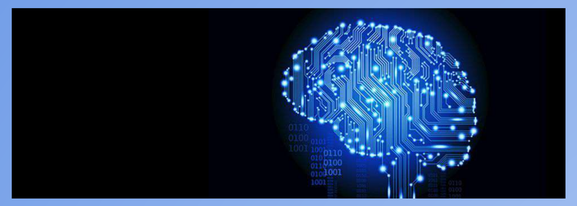
OBJECTIVES

- Develop scaled-down (16:1) proof-of-concept prototypes for various assistive technologies.
- Demonstrate assistive technologies and home modifications to the users.

APPROACHES

- Construct the model house with foam boards and 3D-printed parts.
- Develop a PIC processor based hardware system for motorized animation.
- Develop an Android app for remote controlling animations such as self-lowering cabinet and wheel-chair lifter.





MagnetPeutics

Wearable Helmet using Permanent Magnets driven by Electromagnets for Rehabilitating Stroke Patients

Austin Ramos
Zachary Brown
Juan Malvar

THINK BIG WE DO℠

Objective: To make

Transcranial Magnetic Stimulation more accessible to stroke victims.

Plan:

To make a helmet with permanent magnets that are rotated to induce an electric field to stimulate a patient's brain cells that were affected by a stroke.

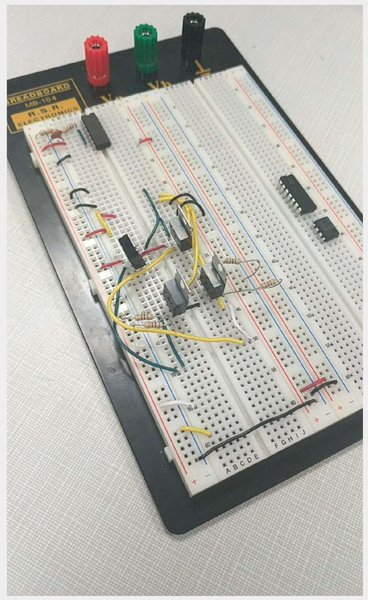
Methods:

Two proposed models:

- For both models the casing for the magnets was 3D printed from a solidworks design.

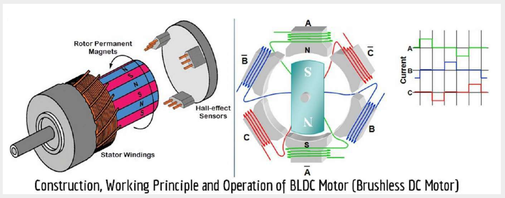
Electromagnets:

- Built a circuit using an H-bridge and 556 timer to create a square wave that can power the electromagnets.
- Used soft iron cores tightly wound with copper wire to make the electromagnets.



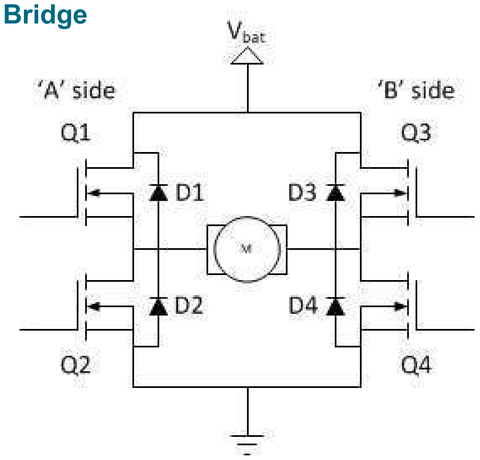
Brushless motor:

- For the brushless motor we use a modified solidworks design.
- The motor will spin the magnet unit with friction.



Construction, Working Principle and Operation of BLDC Motor (Brushless DC Motor)

H Bridge

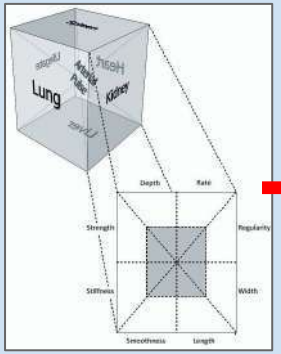


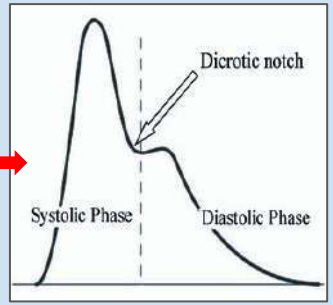
Wrist Pulse Simulation Technology Capable of Representing 28 Pulse Patterns of **T**raditional **C**hinese **M**edicine

Mackenzie Mitchell, Ian Kanterman, Jake Morris

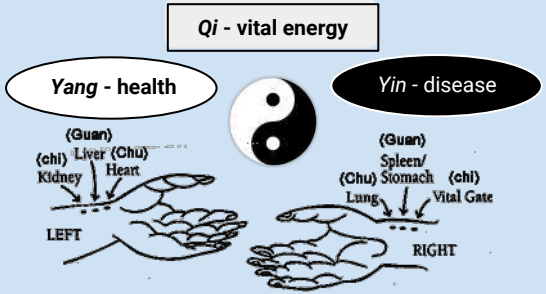
THE UNIVERSITY OF RHODE ISLAND
COLLEGE OF ENGINEERING

Objective: Model 28 pulse patterns by quantifying radial artery pulse characteristics.

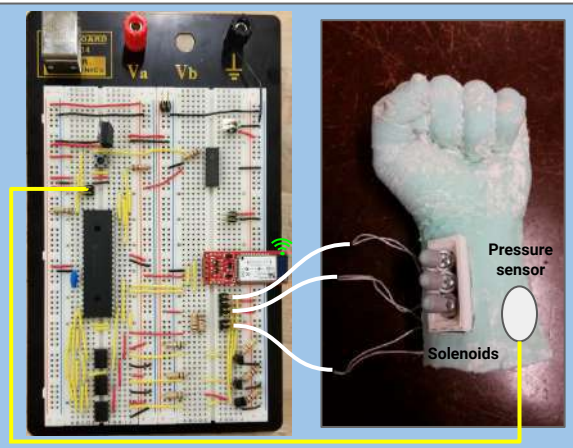


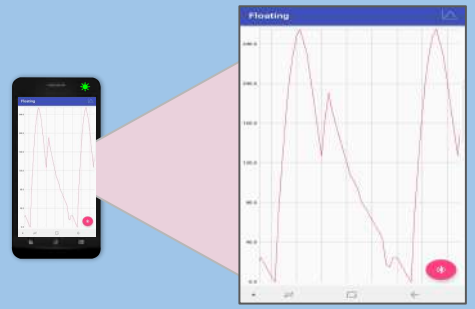


Background Information



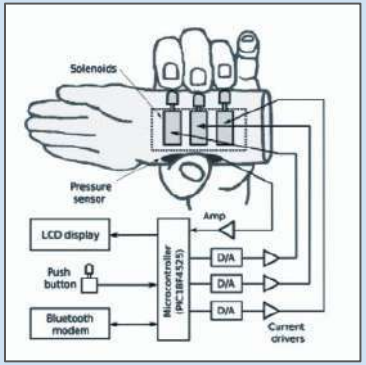
Results

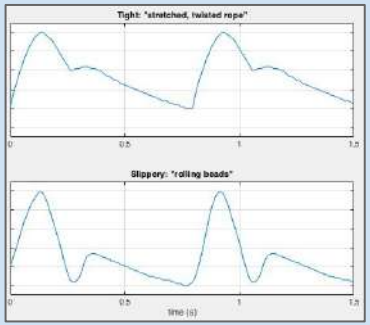




Methods

Hardware Implementation





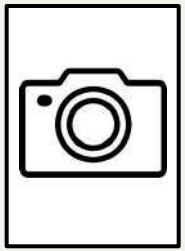
Manipulation of Radial Pulse Waveform

Monitoring pain in individuals who are nonverbal using a video-based algorithm and Android application

Rachel Bellisle, Jessika Decker, and John McLinden

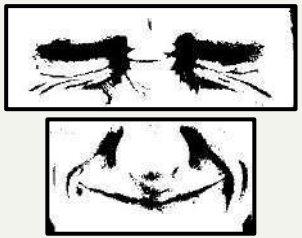
Develop image processing method and design algorithm in MATLAB → Create an Android application that processes images and performs algorithm in real time → Monitor patient and alert caregiver if pain is detected

Original Image



Take an Image

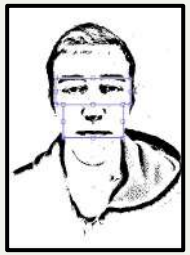
Adaptive Threshold Binary Filter



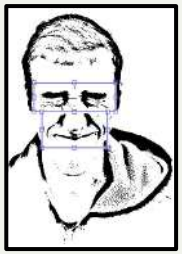
Template Images

New Image

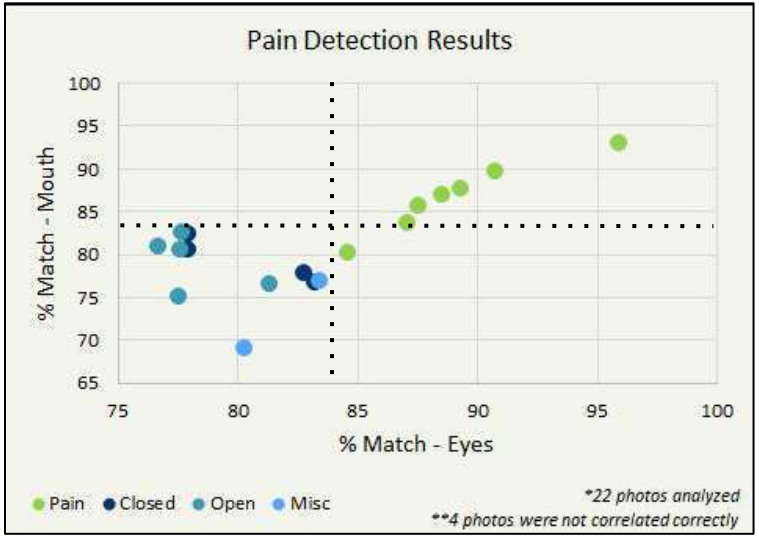
Cross Correlation



% match eyes = 81.30
% match mouth = 76.59



% match eyes = 95.88
% match mouth = 93.04



Proposed Thresholds

- Eyes - 84%
- Mouth - 83%

Next Steps

- Finalizing the app
- Improving the algorithm

Firefighter Digital Assistance

Seth Gergel and Ryan Dolan
University of Rhode Island
45 Upper College Rd.
Kingston, RI 02881

Goals

1. Accurately measure the respiration rate by mounting a pressure sensor (non-invasively) within the gas-mask.
2. Develop an android based app with an intuitive user-interface that can be used reliably in high-stress emergency response situations to provide valuable bio feedback to those in command.
3. Design and implement housing for the exterior components (infrared camera/glove sensor) to shield them from the harsh environments firefighters typically face.

Milestones

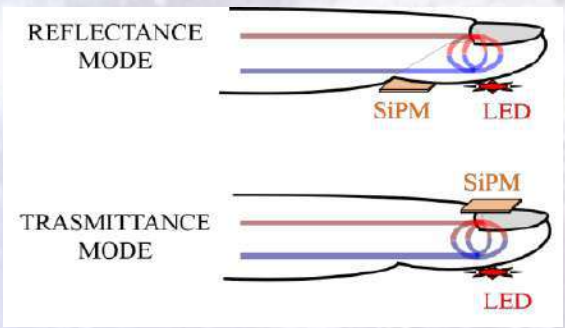
1. Integrated each sensor (ambient temperature, glove temperature, and pressure sensor) with the arduino as well as the OLED screen. (COMPLETE)
2. Obtain the temperature reading from the infrared camera. Display that information on the OLED HUD, as well as transmit that data via bluetooth through our android app.

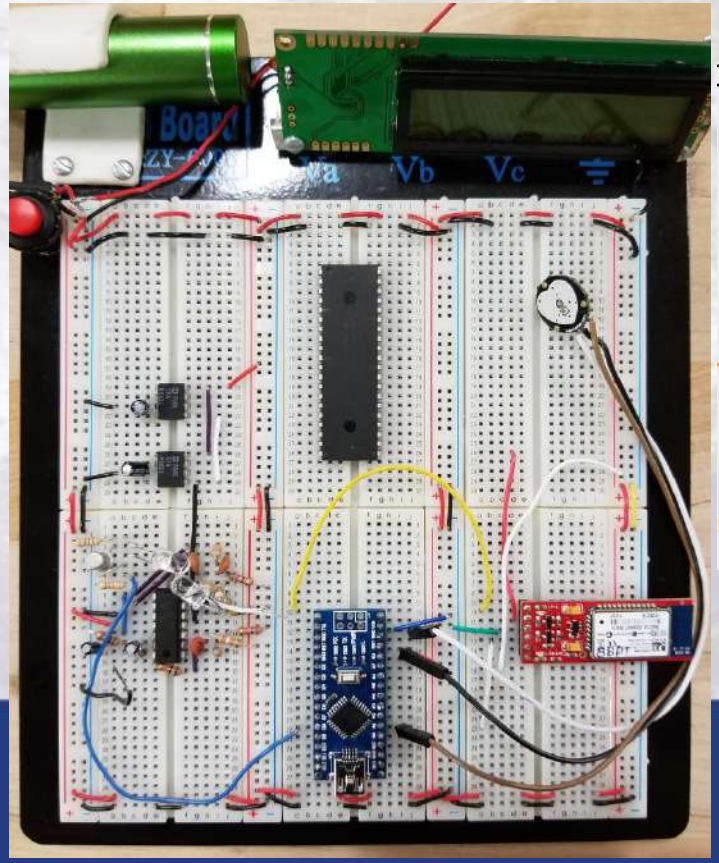
Comparing Effectiveness of Two Sensors on Different Locations for Use in Helmet Sensor

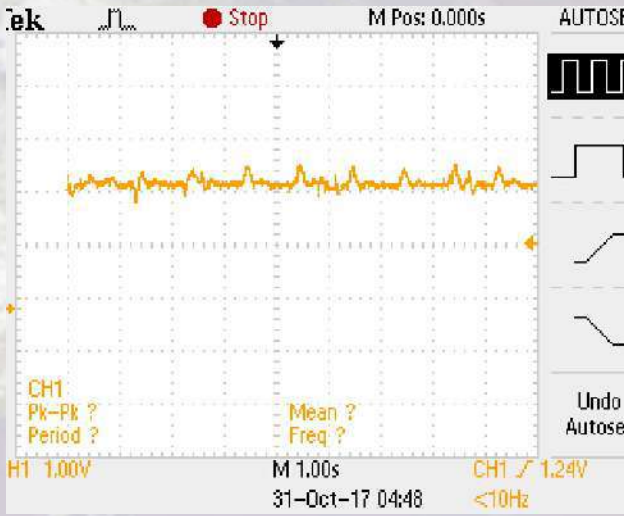
GOAL
-Mountable PPG for firefighter helmet
-Compare different locations for best HR signal

METHOD
-Create two sensors
-Comparison of two sensors on different parts of head

OUTCOME
-Transmittance shows a lot of noise
-Reflectance gives clearer readings





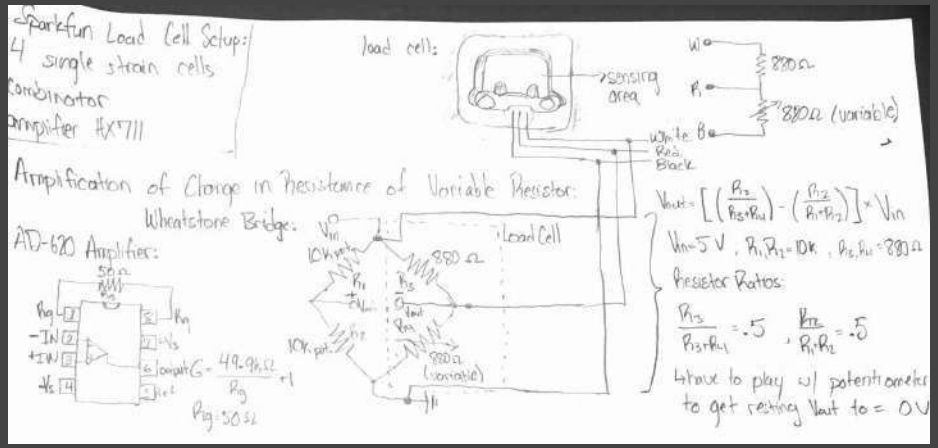


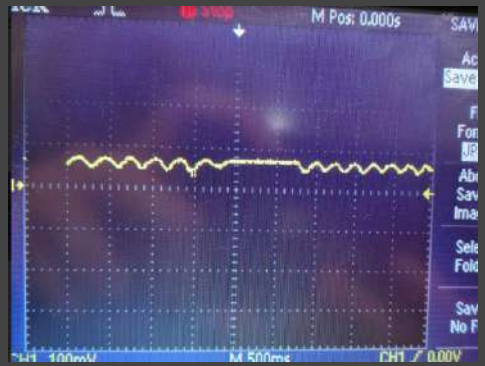
THINK BIG WE DO

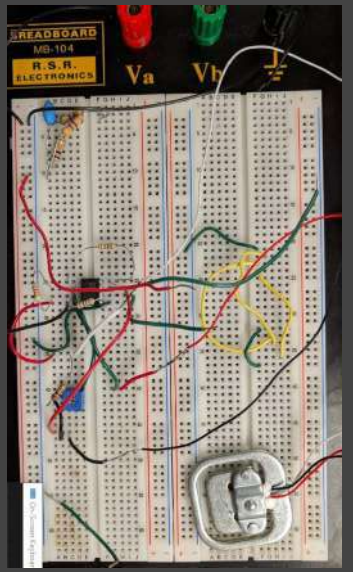
THE UNIVERSITY OF RHODE ISLAND

Intelligent Balance Board for Ankle Injury Prevention/Rehabilitation

- Group Members: TG Ugochukwu, Daniel Salazar Herrera, Matthew Brass
- Current Progress:
  - Intelligent Balance Board that can track movements made by a foot on the board (Demo)
- Objective:
  - Add pressure/force sensing elements to increase diagnostic abilities for ankle rehab

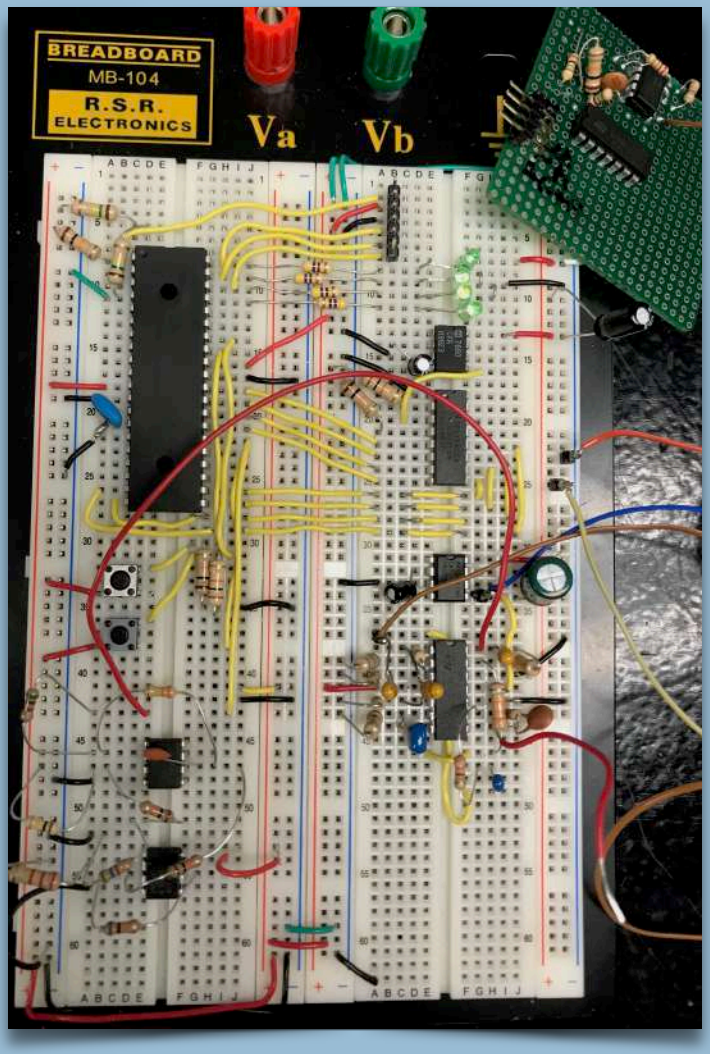


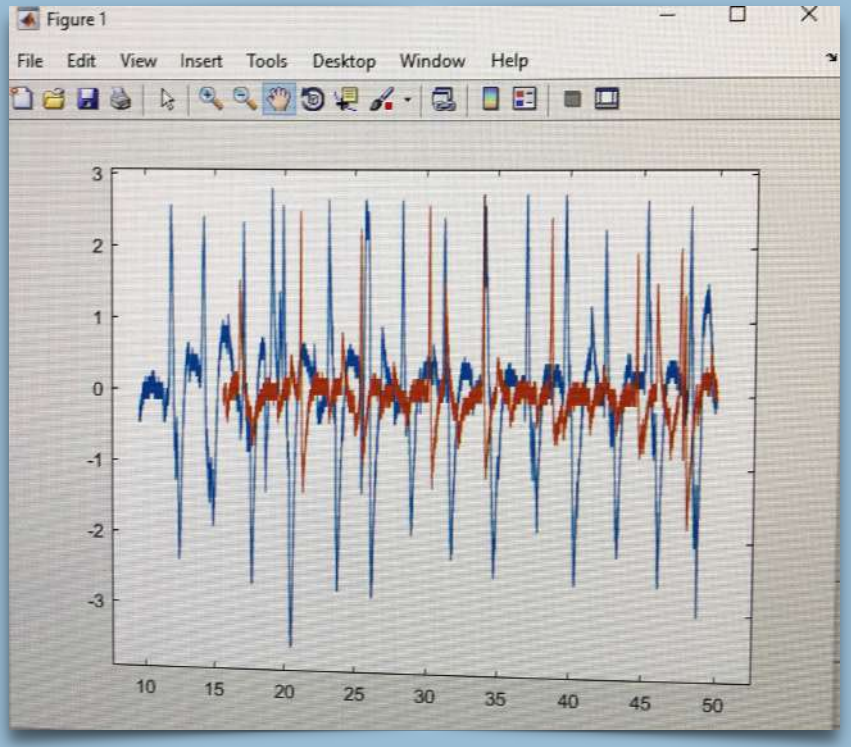


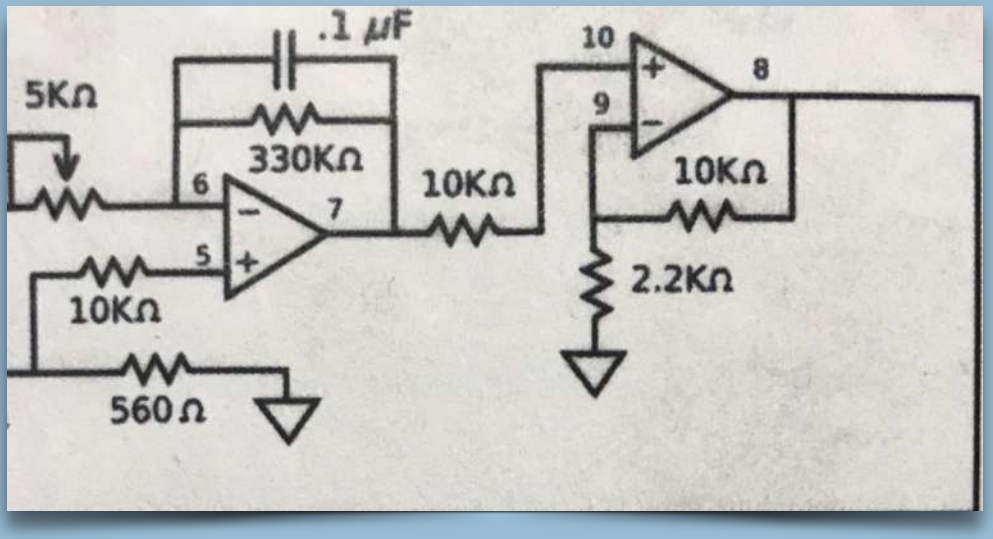


EOG and EMG Environmental Control for Patients with Mobility and Communicative Disabilities

Objective: To design a system that uses an EOG and EMG signal to read the differences in intentional and unintentional blinking to allow those with disabilities to control with the environment around them.



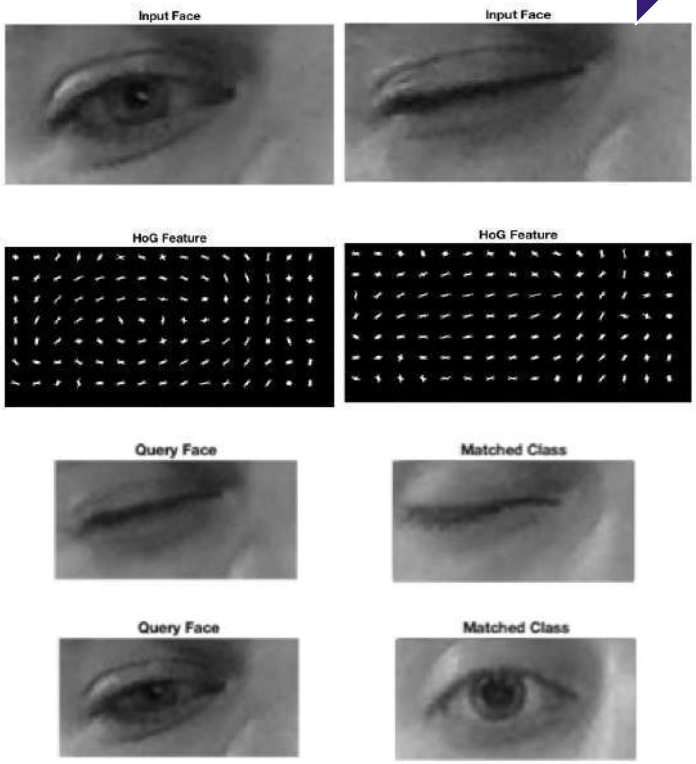




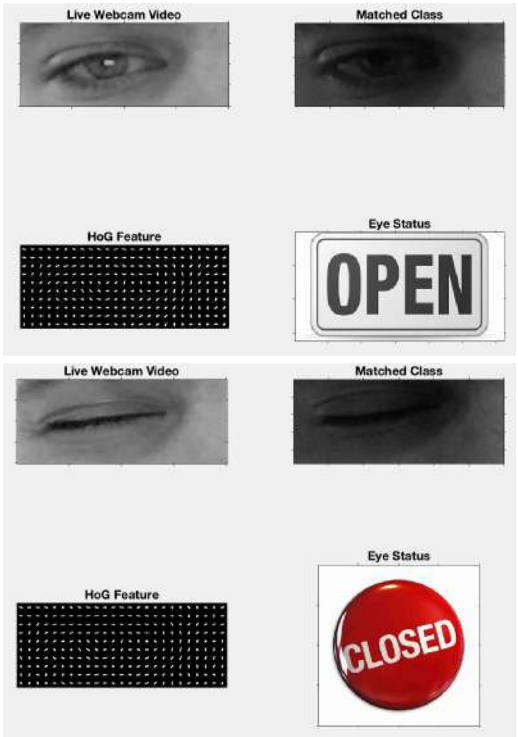
Video-Based Eye Blink Detection

Rachael Amore, Jason Mercier, and Sawyer Nichols

Using HoG, determine if picture of eye is open or closed



Continue development to work with real time video



Work with Arduino board via MATLAB

When light is on, eye is closed
When light is off, eye is open

The next step for this project is to work with Android Studio to develop an app that receives information via bluetooth and displays it on a mobile device.

Integrated Pulse Oximeter for Portable Vital Assessment

Rory Caldas, Derek Santos

Device Performance Goals:

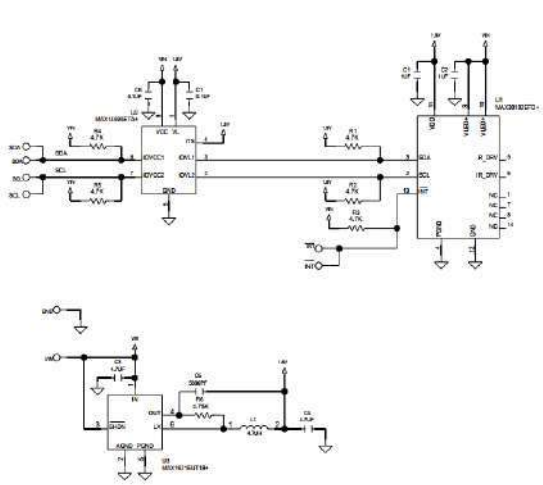
- Accurate arterial saturation measurement
- Integration with existing ECG functionality
- Accurate propagation velocity analysis
- Portability

Progress:

- Ground-up I2C source code
- Hardware integration of Pulse Oximeter chip (MAXREFDES 117#)
- Basic logic-level interaction between Pulse Oximeter and PIC Microprocessor
- 3D design of sensor housing in SolidWorks

Future Goals:

- Obtain seamless integration of Pulse Oximetry chip with existing system
- Incorporate finger housing into overall system design
- Adapt PICScope app to interface with Pulse Oximetry functionality
- Inclusive diagnostic report



```
void SetUpI2C(const unsigned long s)  {   /******Initialize I2C Protocol********/
    SSPCON1bits.SSPEN = 1;
    SSPCON1bits.SSPM3 = 1;
    SSPCON1bits.SSPM2 = 0;
    SSPCON1bits.SSPM1 = 0;
    SSPCON1bits.SSPM0 = 0;
    SSPADD = (_XTAL_FREQ/(4*s))-1;
    SSPCON2 = 0;
    SSPSTAT = 0;

    TRISC3 = 1;
    TRISC4 = 1;
}

void I2CWait() {
    while ((SSPSTAT & 0x04) || (SSPCON2 & 0x1F)); //Transmit in Progress
}
void I2CStart()  {
    I2CWait();
    SSPCON2bits.SEN = 1;

}
void I2CRepeatStart()  {
    I2CWait();
    SSPCON2bits.RSEN = 1;
}
void I2CStop()  {
    I2CWait();
    SSPCON2bits.PEN = 1;
}
void I2CWrite(unsigned char I)  {
    I2CWait();
    SSPBUF = I;
}

unsigned char I2CRead(unsigned char J) {
    unsigned char Ivalue;
    I2CWait();
    SSPCON2bits.RCEN = 1;
    I2CWait();
    Ivalue = SSPBUF;
    I2CWait();
```

```
case 10:
    TMR0H = 0xFC;       // Reload TMR0 for 1 ms count, sampling rate = 1KHz
    TMR0L = 0x4D;
    SetUpI2C(100000);
    while (1)  {
        I2CStart();
        I2CWrite(0xAE);
        I2CWrite(0x09);
        I2CWrite(0x03);

        I2CRepeatStart();
        I2CWrite(0xAE);
        I2CWrite(0x00);
        I2CRepeatStart();
        I2CWrite(0xAF);
        I2CRead(0);

        I2CRepeatStart();
        I2CWrite(0xAE);
        I2CWrite(0x30);
        I2CWrite(0x01);
        I2CStop();
        __delay_ms(200);

        I2CStart();
        I2CWrite(0xAE);
        I2CWrite(0x04);
        __delay_ms(200);
        I2CRepeatStart();
        I2CWrite(0xAF);
        I2CRead(0);
        I2CStop();
        __delay_ms(200);
        I2CStart();
        I2CWrite(0xAE);
        I2CWrite(0x07);
        I2CRepeatStart();
        I2CWrite(0xAF);
        I2CRead(0);
        I2CStop();
```

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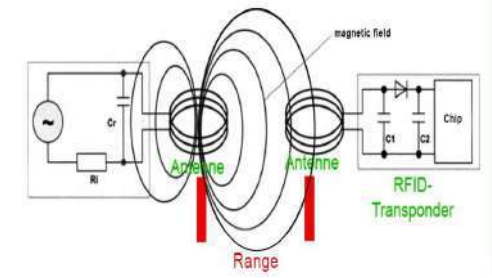
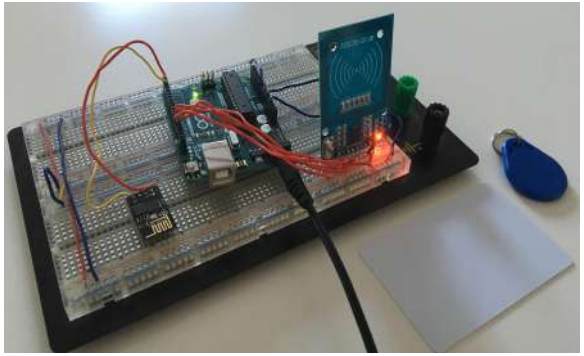
COLLEGE OF ENGINEERING

Radio Frequency Identification Tracking for Hospital Personnel

Delaney Santos, Lauren Porto, Tyler Gagan

What is RFID?





Current Progress

Hardware: The Arduino polls the tag reader to check if it has received a tag. If the tag has been received, it sends the unique ID number to the Arduino, which can then be displayed on the serial monitor.

Software: An Arduino sketch was written to interface the Arduino with the RFID interrogator. A website has also been created to serve as a database that can also be logged into by authorized personnel.

```
**Card Detected:**
Card UID: 3D 46 94 E5
Card SAK: 08
PICC type: MIFARE 1KB
Name: Tyler Gagan
**End Reading**
```

Challenges Thus Far

- Hardware and Software
- Android Studio

Future Goals

- Android application
- WiFi communication with website

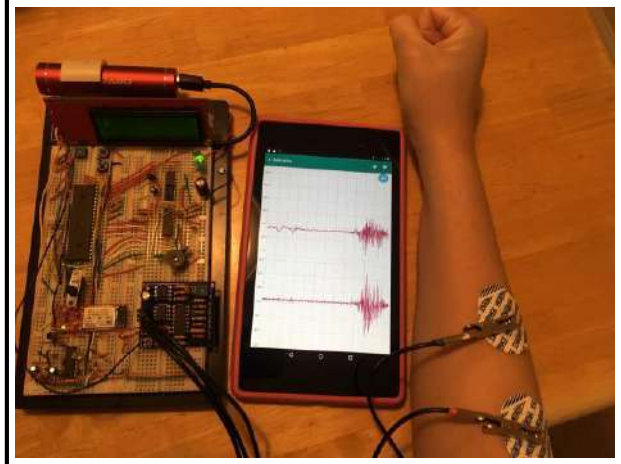
Real-Time Spectrogram of Electromyography(EMG) Signals on Android Application

Melissa Santi and James Baez

Objective

Create an app that plots the spectrogram of EMG signals allowing for analysis in real time

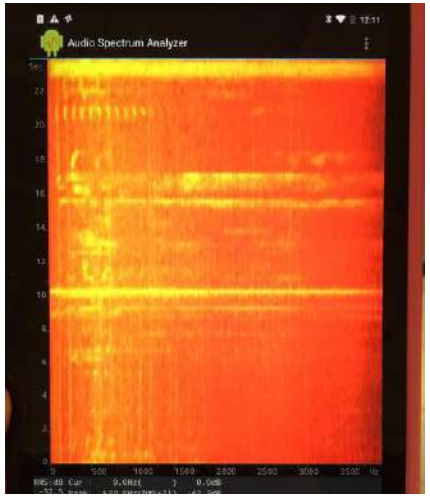
Results



Raw EMG signal on Picscope app

Methods

(Audio Spectrogram)



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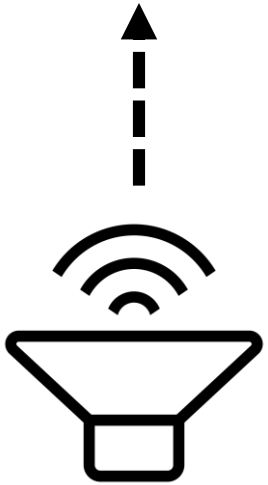
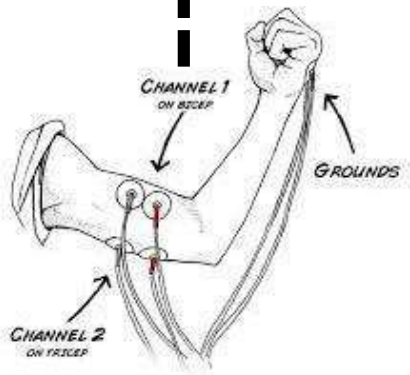
(EMG signal)

=





Replace input of Audio Spectrogram App with EMG input to create EMG Spectrogram App

Tee It UP : A Smart Golf Mat with Integrated Infrared Technology for the Visually Impaired

Jeremy Doody, Scott Barlow, Mary Ellen Sweeney

Introduction

- Golfing for visually impaired Veterans
- Adaptive golf mat
- Correct alignment for teeing off

Method & Functionality

- Arduino 101 microprocessor
- Infrared sensors for distance detection
- Speaker for auditory notification of alignment
- 3D printed sensor mounts
- Integrated bumpers

Schematics

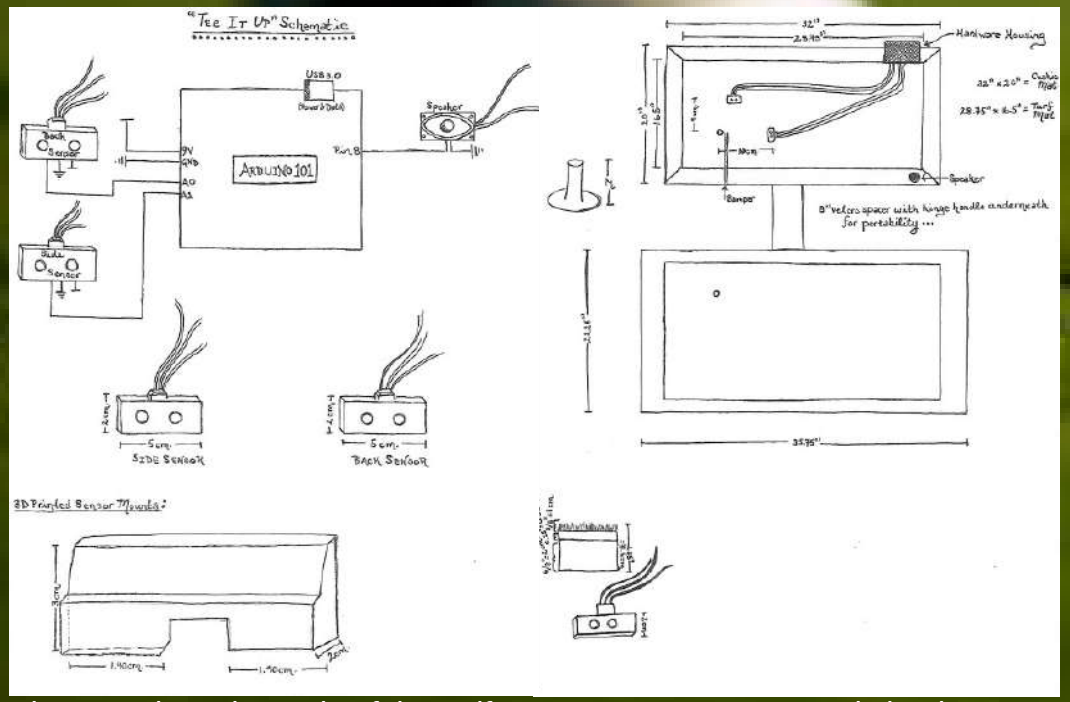


Figure 1: the schematic of the golf mat, sensors, mount, and circuit

Figure 2 and 3: The hitting mat

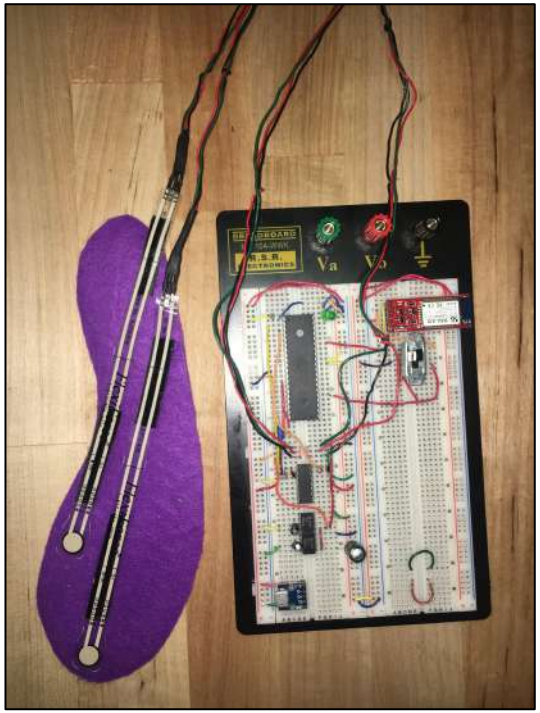
Intelligent Pressure Sensing Rock Climbing Shoes for Contact Detection of Lower Extremity Prosthetics

Emma Orton, Riley Temple, and Jillian Holden

Objective

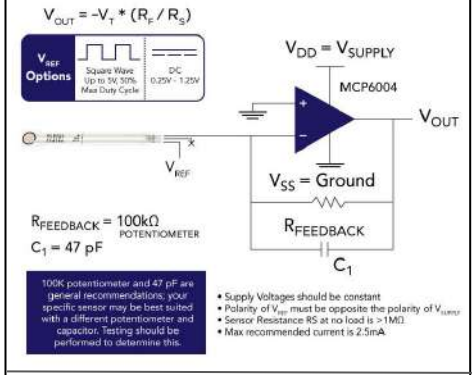
Create a more accessible option for Veterans with lower limb prosthetics to participate in the rock climbing program

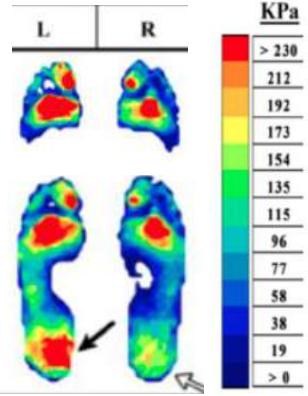
Results



Sensor output displayed in Android app, with auditory feedback to signal stability

Methods





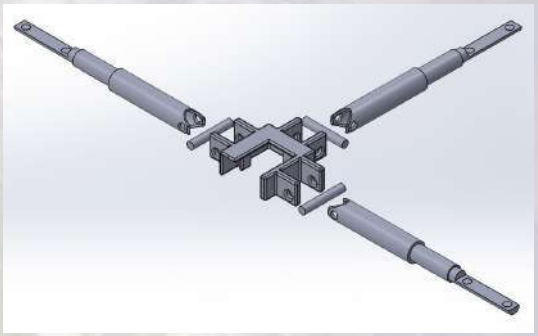
Magnetic Arm System for Safe Storage and Transportation of IV Poles

Simply saving time for the things that matter

Takes two or three trips from room to destination

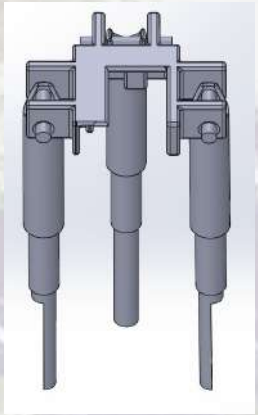
Able to transport 2 to 6 IV poles in one trip

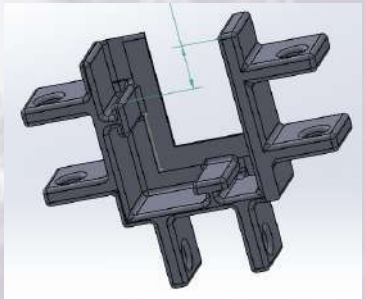
- PVC pipe
- 1/2 in x 1/4in neodymium magnet
- Silicone covering
- OmniMed IV clamp



1 pole can connect to **3** other IV poles with 50lbs pull force

SIMPLE to use telescoping arms that connect to other arms by magnets





THINK BIG WE DO™

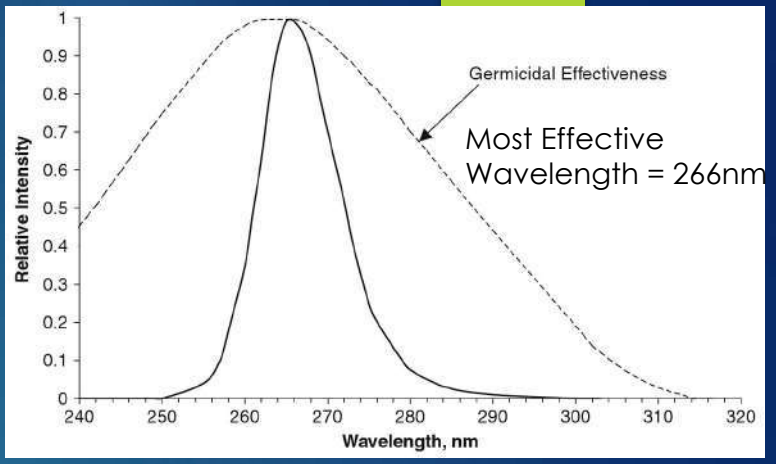
THE UNIVERSITY OF RHODE ISLAND

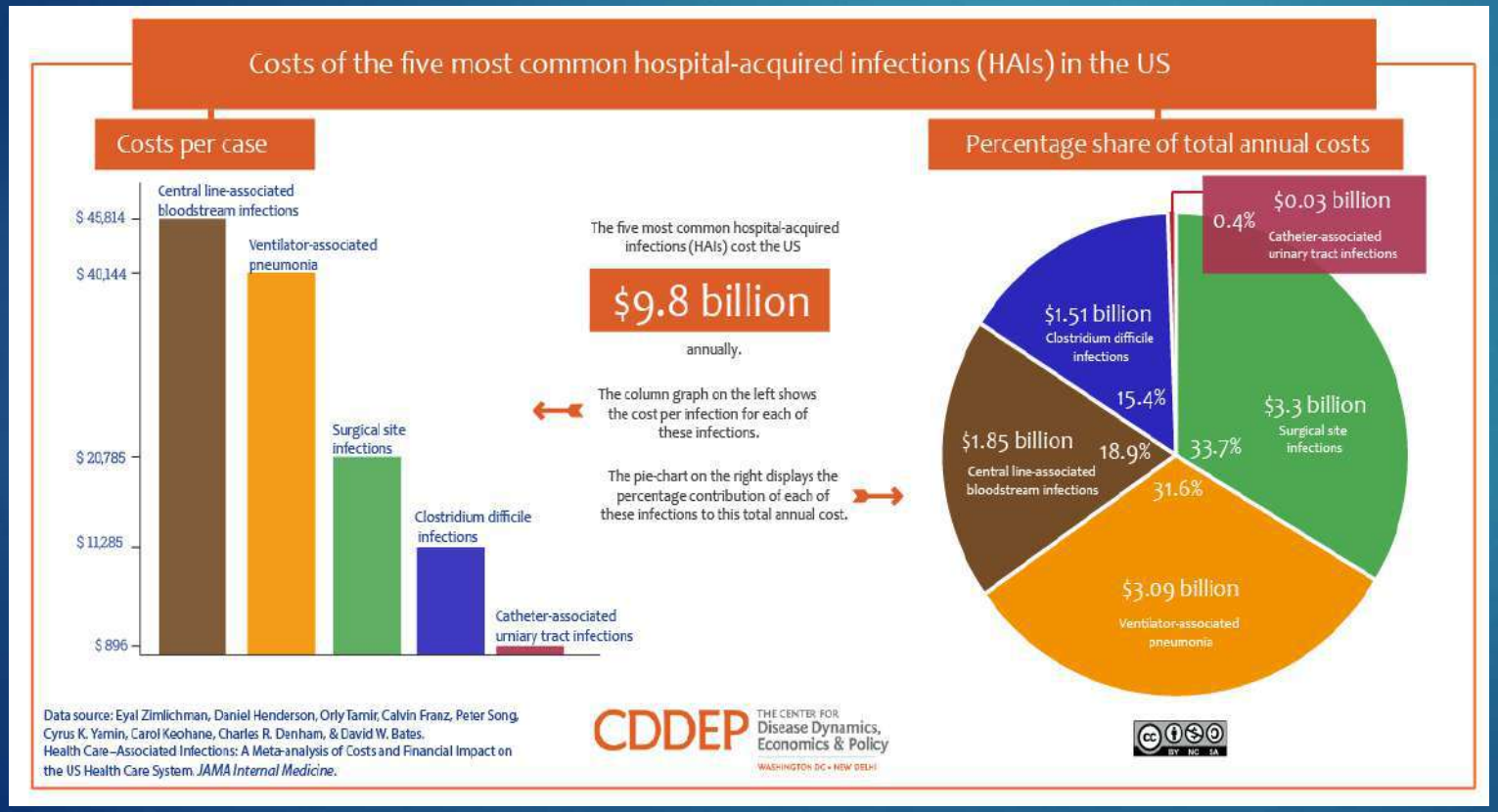
Margaret Franklin, Daniel Haberek, Daniel O'Brien
Advisor: Jordan Anderson

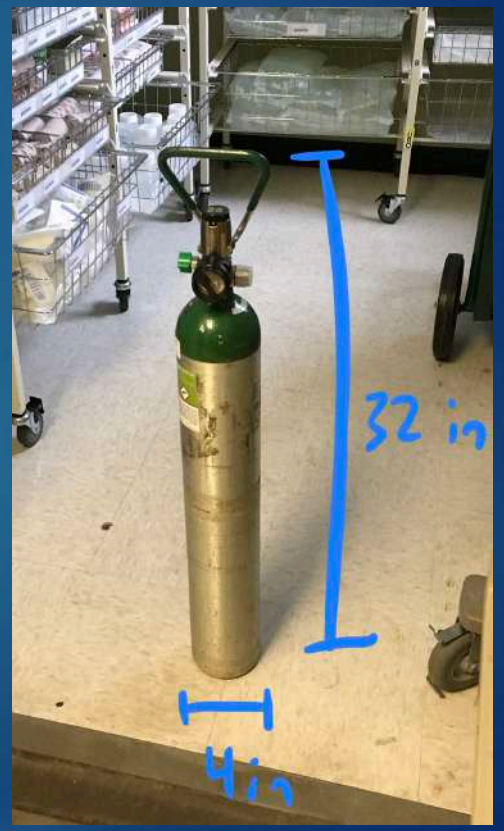
Germicidal Ultraviolet Light Enclosure For Disinfection of Medical Equipment to Prevent Hospital Acquired Infections

WILLIAM KIERNAN, DAN MEDEIROS, & KYLE RILEY

- UV light can be used to kill bacteria by destroying the DNA in each cell
- Using this technology it is possible to sanitize hospital equipment
- This application focuses mainly on E size oxygen cylinders







- *UV-C LED emitting 265 nm compared to e.coli germicidal effectiveness curve. Ultraviolet Germicidal Irradiation Handbook - Fig. 5.5*. Digital image. *Wikipedia*. N.p., 6 Feb. 2017. Web. 12 Nov. 2017.
- *Overall and unit costs of the five most common hospital-acquired infections (HAIs) in the US*. Digital image. *Cddep.org*. The Center For Disease Dynamics, Economics & Policy, n.d. Web. 12 Nov. 2017.