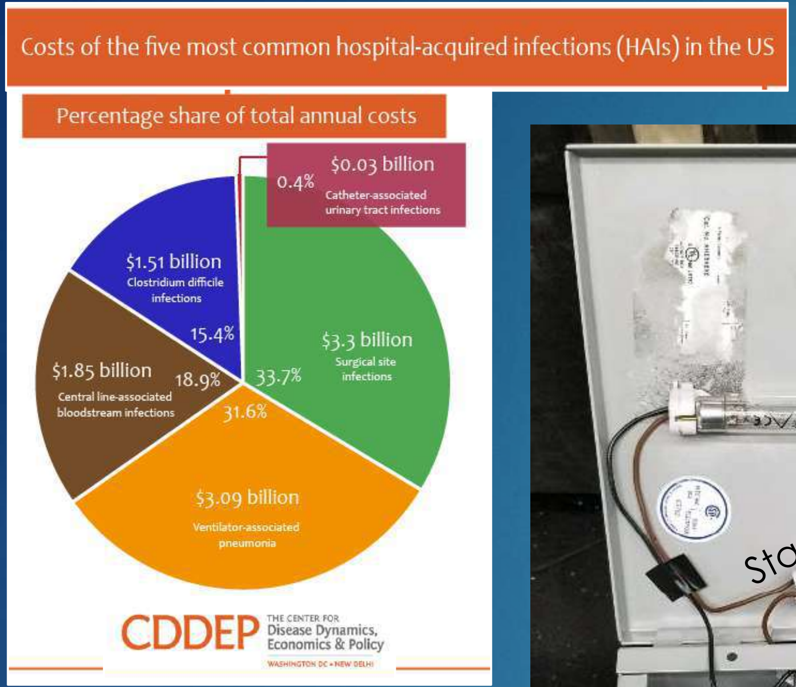
Germicidal Ultraviolet Light Enclosure For Disinfection of Medical Equipment to Prevent Hospital Acquired Infections

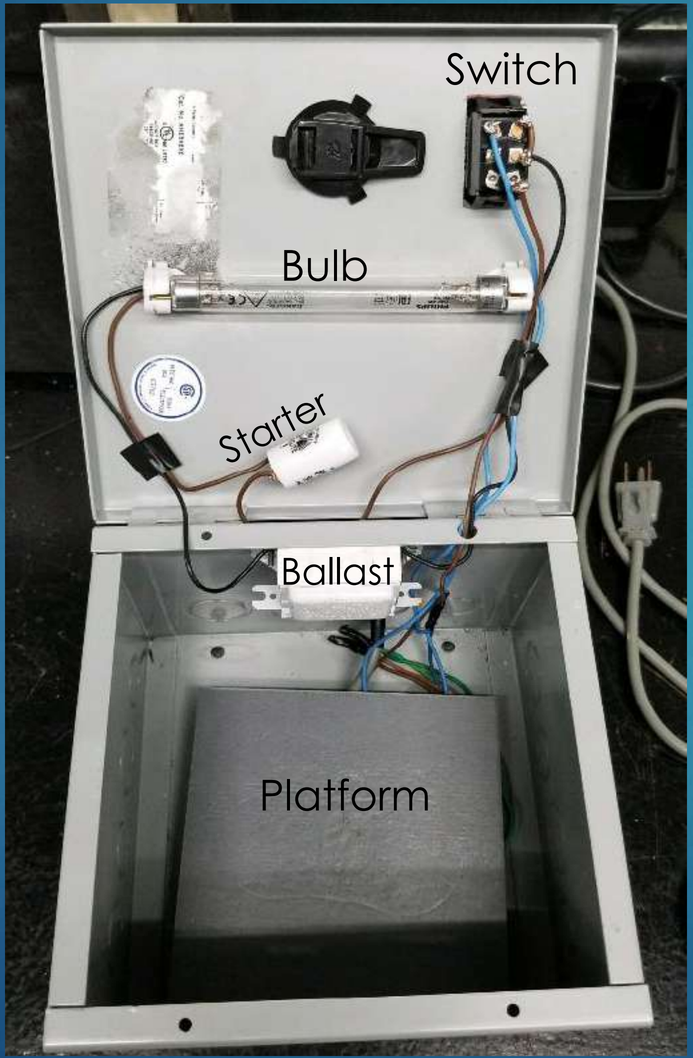
WILLIAM KIERNAN, DANIEL MEDEIROS, & KYLE RILEY



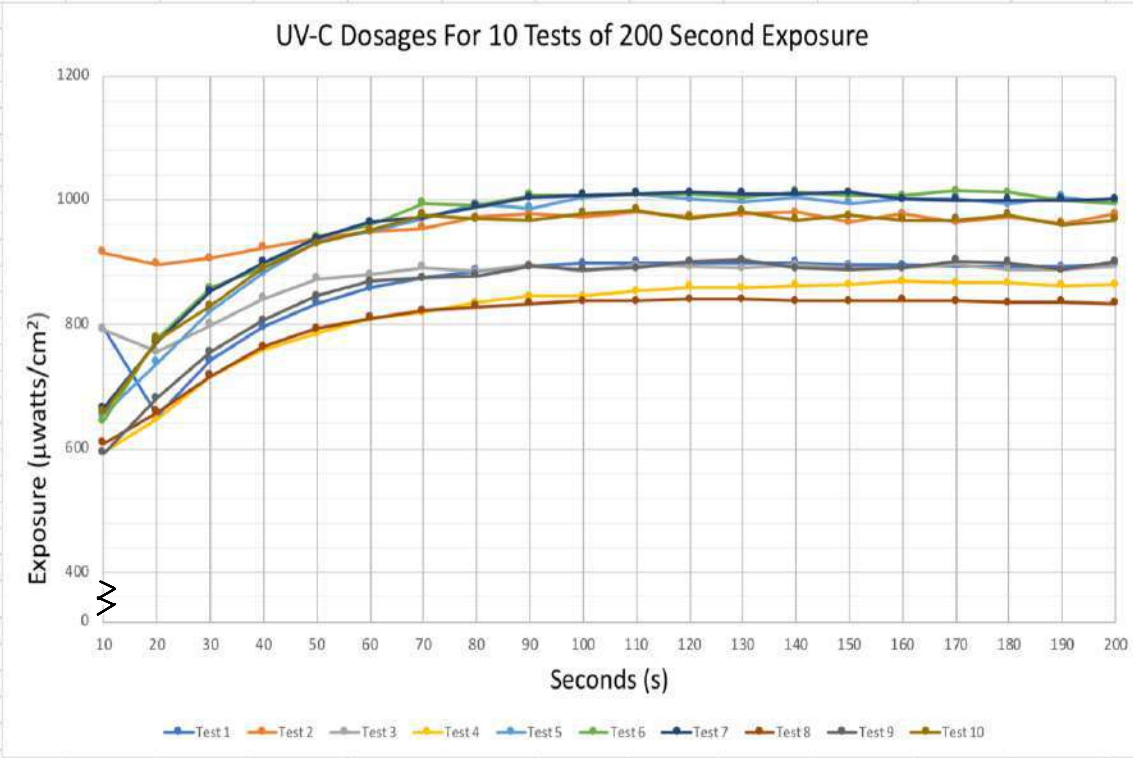
The five most common hospital-acquired infections (HAIs) cost the US

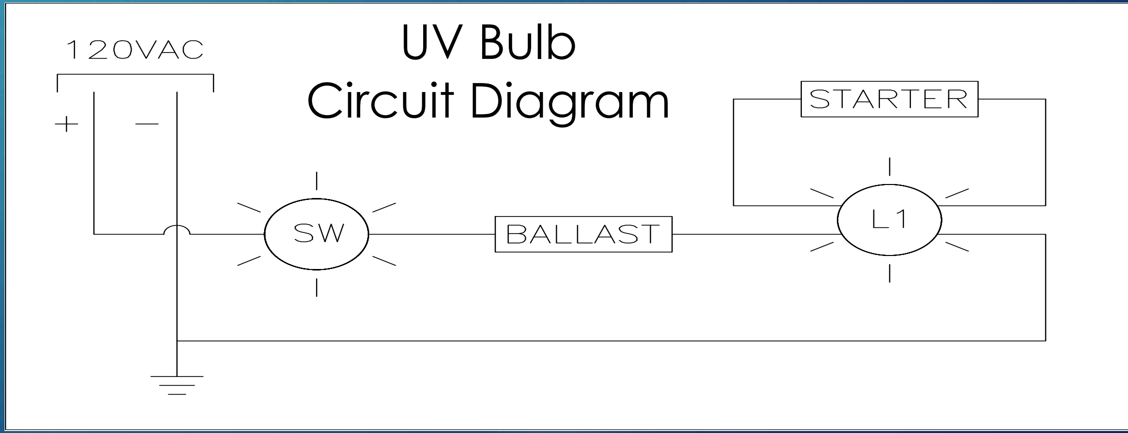
$9.8 billion

annually.



Final Configuration





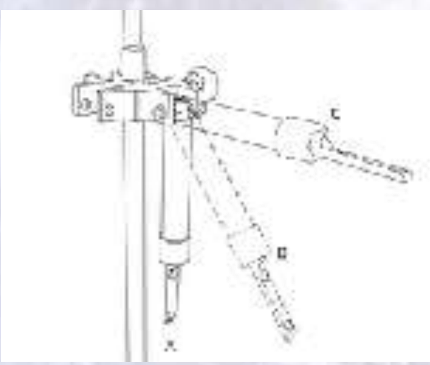
- *Overall and unit costs of the five most common hospital-acquired infections (HAIs) in the US*. Digital image. *Cddep.org*. The Center For Disease Dynamics, Economics & Policy, n.d. Web. 12 Nov. 2017.

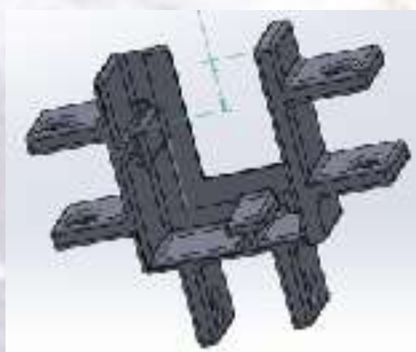
Coupling System for Safe Storage and Transportation of IV Poles

Simply saving time for the things that matter

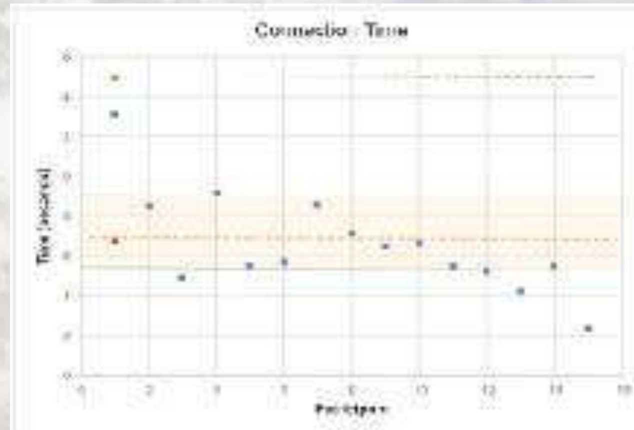
akes two or three trips from room to destination

Able to transport 2 to 6 IV poles in one trip





Results



Mean Assembly Time (seconds): 6.82

Mean Disassembly Time (seconds): 6.62

Likert Scale Post-trial Survey:

Prototype meets all design goals in user satisfaction

THINK BIG WE DO

THE UNIVERSITY OF RHODE ISLAND

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

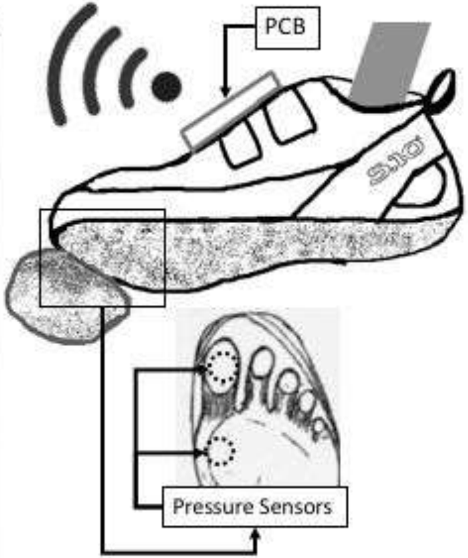
Intelligent Pressure Sensing Rock Climbing Shoes for Contact Detection of Lower Extremity Prosthetics

Emma Orton, Riley Temple, Jillian Holden, and Jordan Anderson

Objective

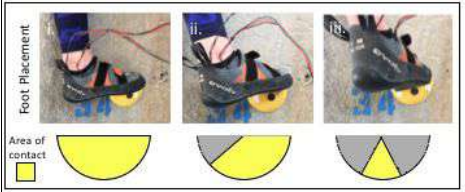
Create a more accessible option for Veterans with lower limb prosthetics to participate in the rock climbing program

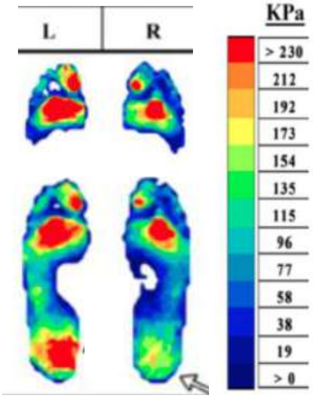
Results



Correct / False Negative / False Positive	Auditory Feedback	
	Yes	No
Stable (n=46)	86.96%	13.04%
Unstable (n=14)	0.00%	100.00%

Methods





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
- Control box

Results

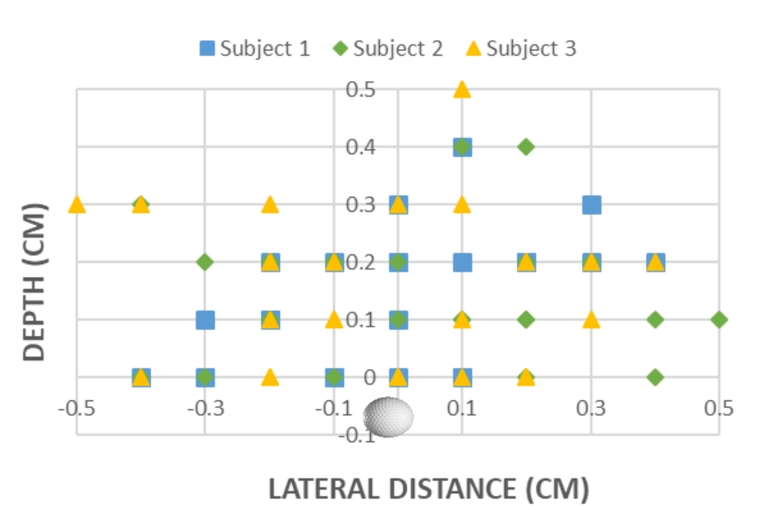


Figure 1: Test results of three blindfolded subjects ability to align club correctly to the ball after performing 30 trials each

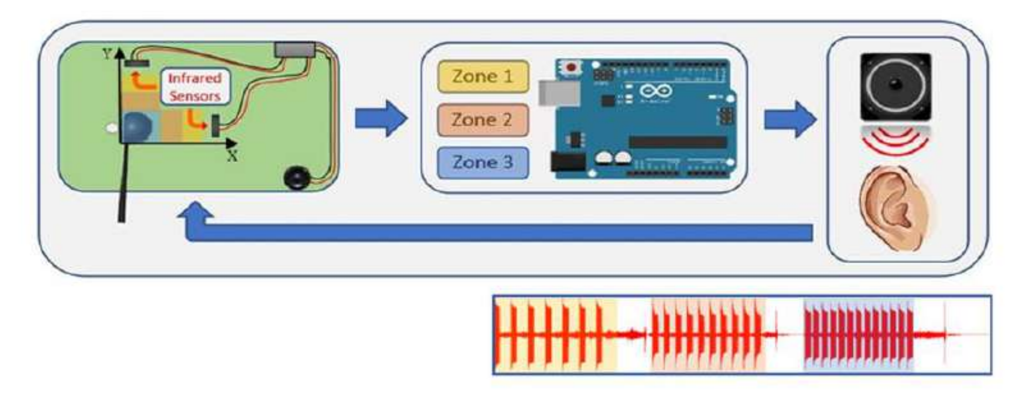


Figure 2: System diagram depicted above, with audio frequency response of three zones

Figure 3: The hitting and standing mats

Implementing Force Sensing Technology

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

Trigno Avanti

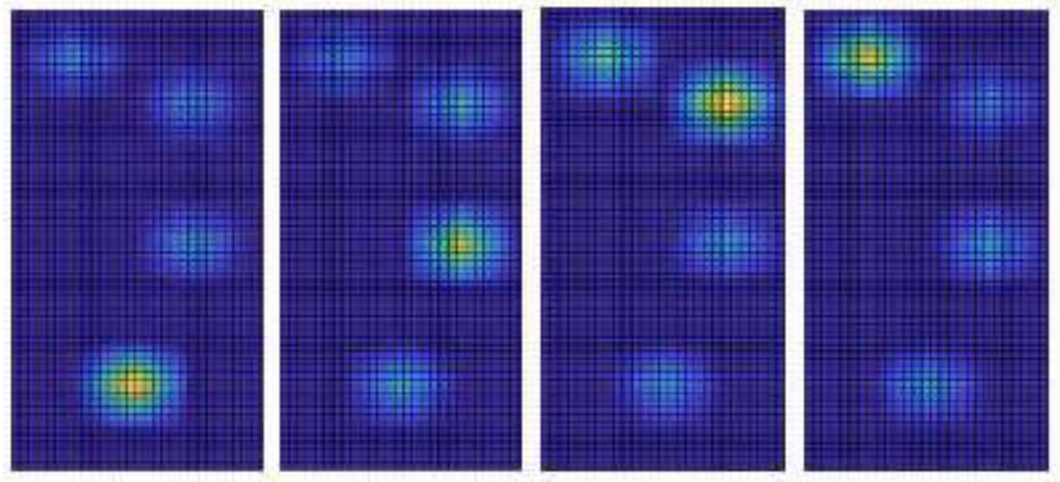
The purpose of this project is to create a compressible shoe insole for monitoring foot pressure distribution alongside EMG+IMU data.

Sensor

The sensor uses a piezo-resistive technology packaged with a bride circuit and flexible membrane.

Prototype

The insole consists of integrated electronics which amplify, sample, and transmit data from the 4 pressure sensors to an intuitive android application.



Pressure Map

By pairing the collected data with a pressure map script, the user can easily compare many distributions depending on patient's health, action, or response.

DELSYS®

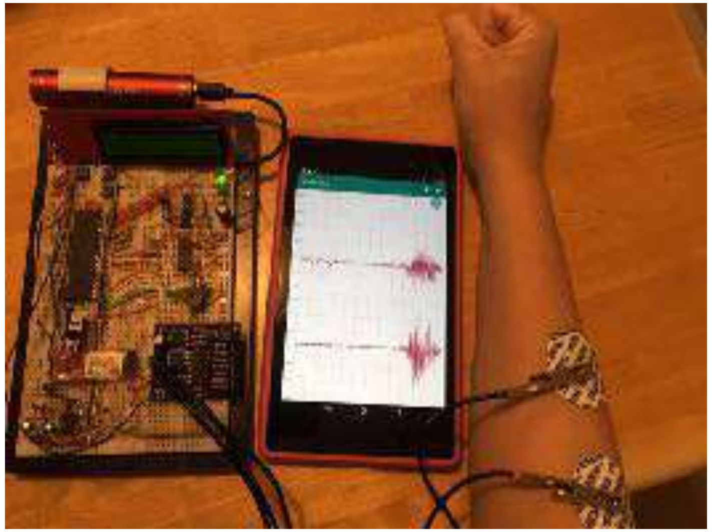
Portable Spectrogram of Electromyography(EMG) Signals for Neuromuscular Research

Melissa Santi and James Baez

Objective

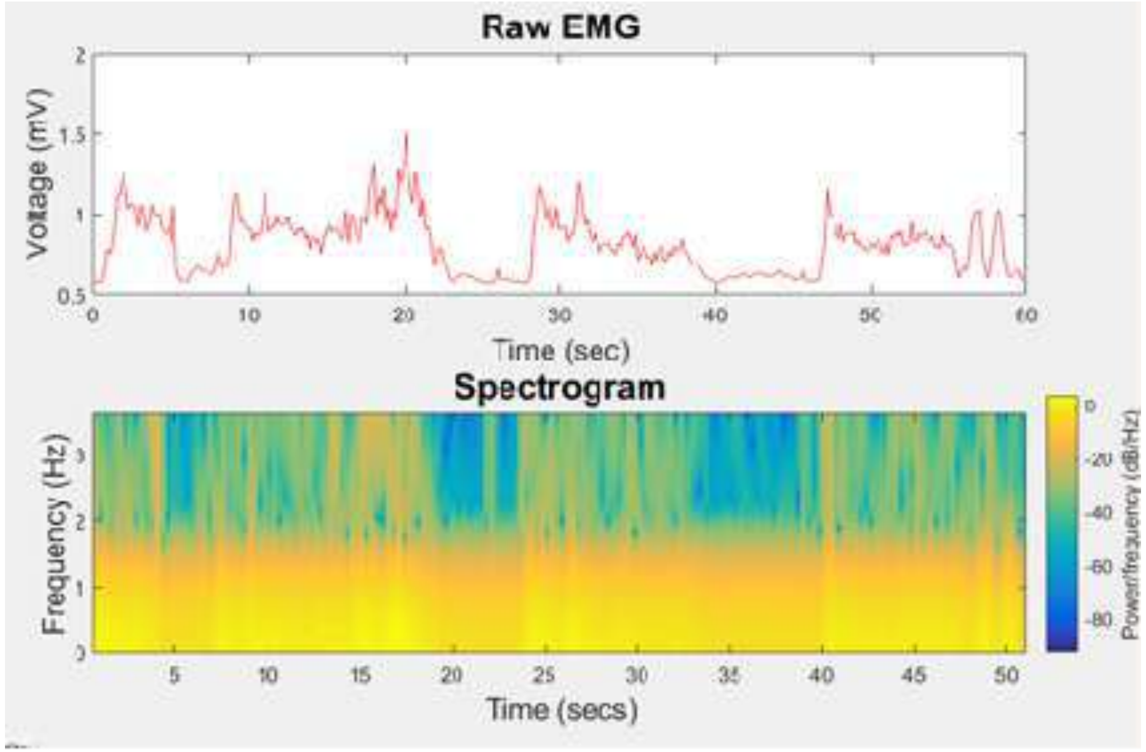
to provide a new Android tool capable of analyzing Electromyography (EMG) signals by using the Spectrogram for use of clinical research and diagnosis of neuromuscular disorders.

Methods



Replace recorded EMG data with Bluetooth input in real time

Results



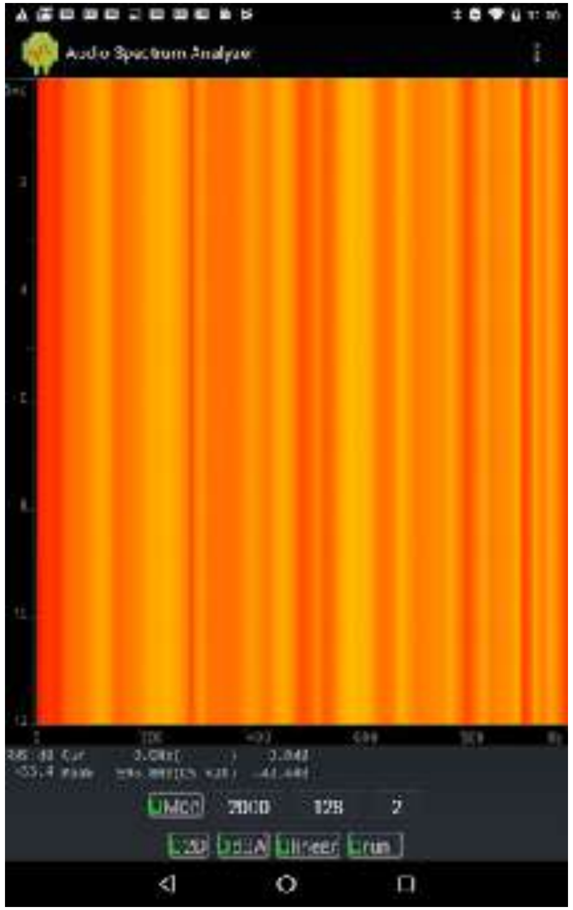


Figure: Raw EMG signal of brachioradialis muscle with generated Spectrogram in MATLAB(left) and Spectrogram of same EMG data imported to Android Application(right)

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Radio Frequency Identification Tracking for Hospital Personnel

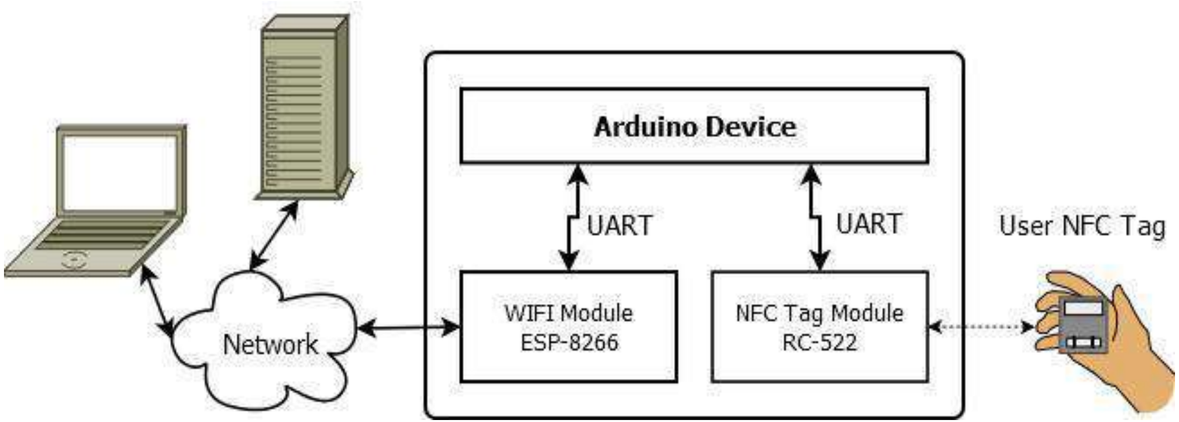
Delaney Santos, Lauren Porto, Tyler Gagan

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.

Software Challenges

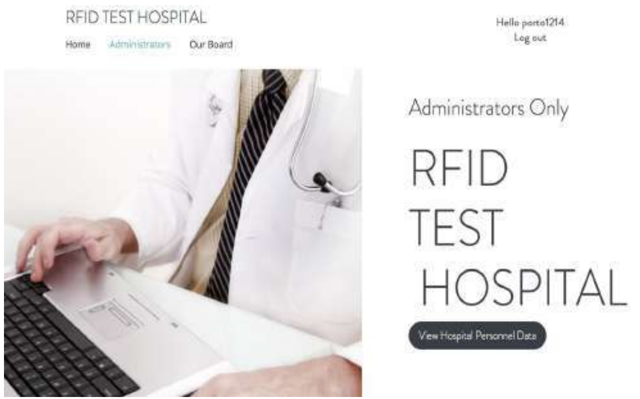
- WiFi Module Initialization
- Multiple component sketches




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

Future Developments

- Downsize device
- Integrate screen for photo ID
- Biometric data
- Increase RFID range



Integrated Pulse Oximeter for Portable Vital Assessment

Rory Caldas, Derek Santos

Device Performance Goals:

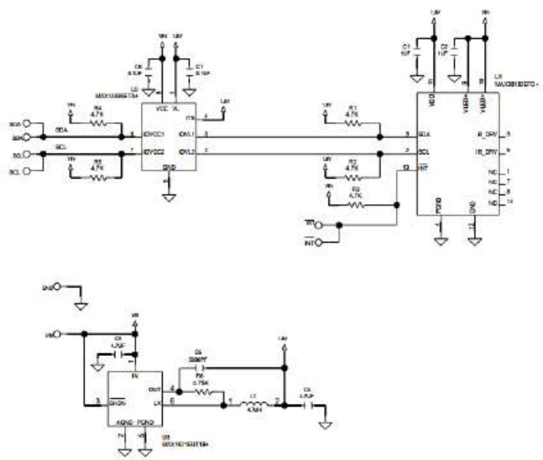
- Accurate arterial saturation measurement
- Integration with existing ECG functionality
- Accurate propagation velocity analysis
- Portability

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();
```

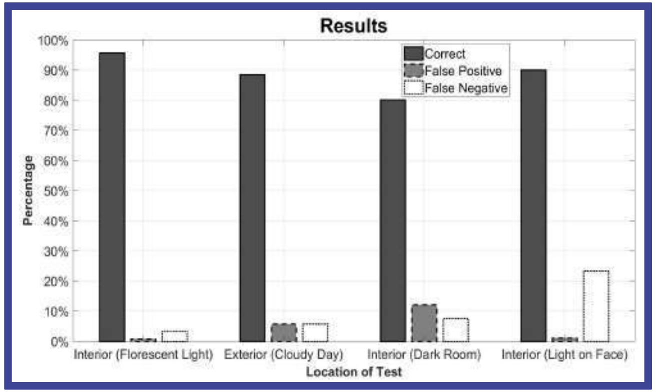
Video-Based Eye Blink Detection

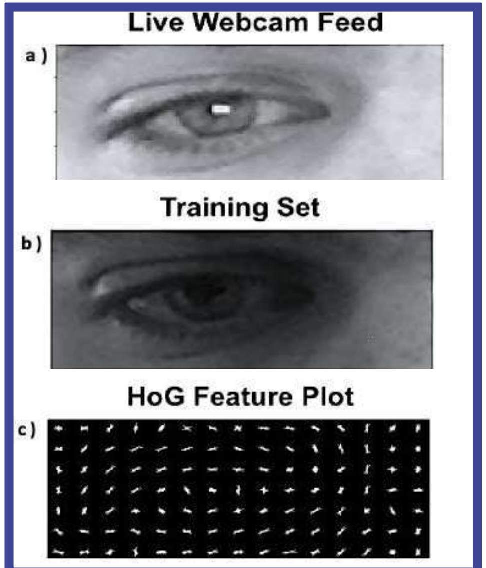
Rachael Amore, Jason Mercier, and Sawyer Nichols

Using HoG, determine if image of eye is open or closed, and continue development with real time video

Use Arduino UNO and Red Bear BLE Shield to display results to mobile app

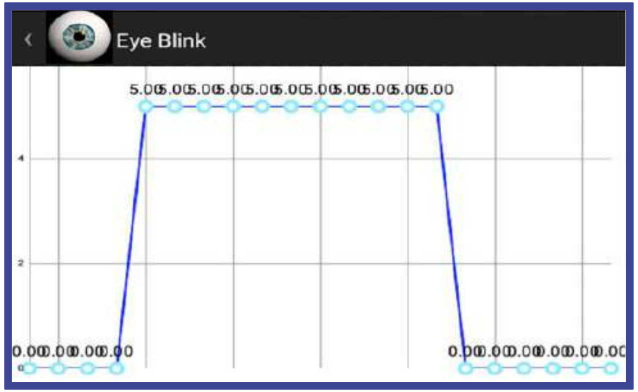
Improve design for multiple platforms and optimize eye detection range/accuracy





a) Live webcam video feed, b) predicted match from the SVM algorithm using the training set images, c) HoG feature plot of image used to match the training set images to the live webcam feed

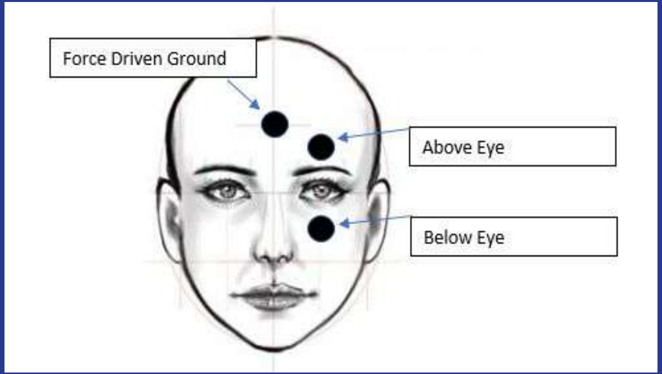
When the eye is closed, the graph displays a 5; when the eye is opened, the graph displays a 0.

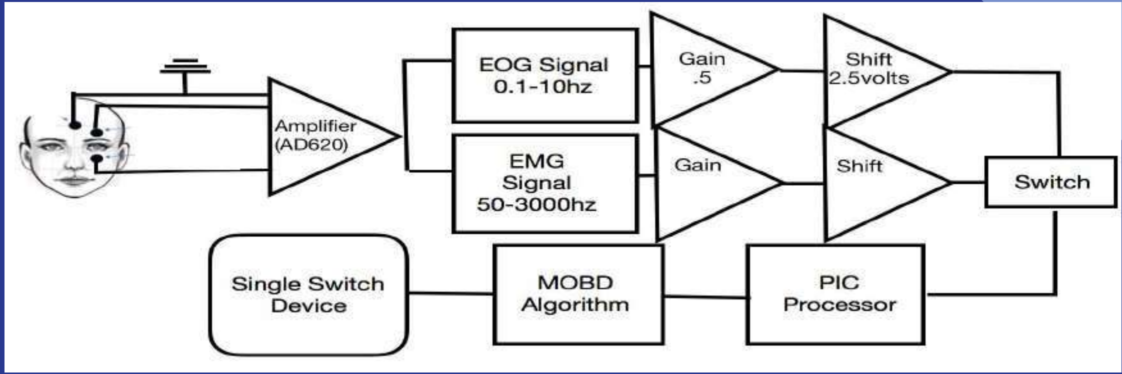


Future Development - Combine all features into one mobile device application that processes eye blink realtime to enable hands-free control from bed rest.

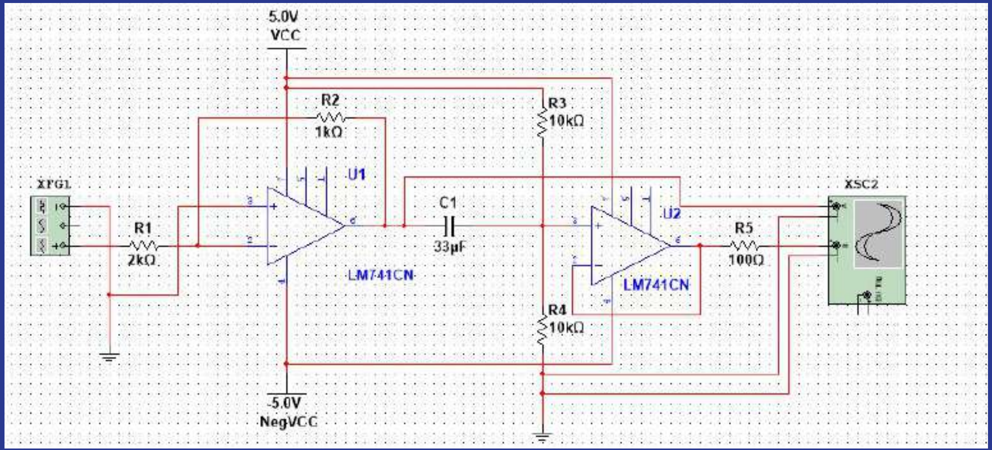
Acknowledgements - Nathan B. Ankomah-Mensah, Zachary Silveira (app development)

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



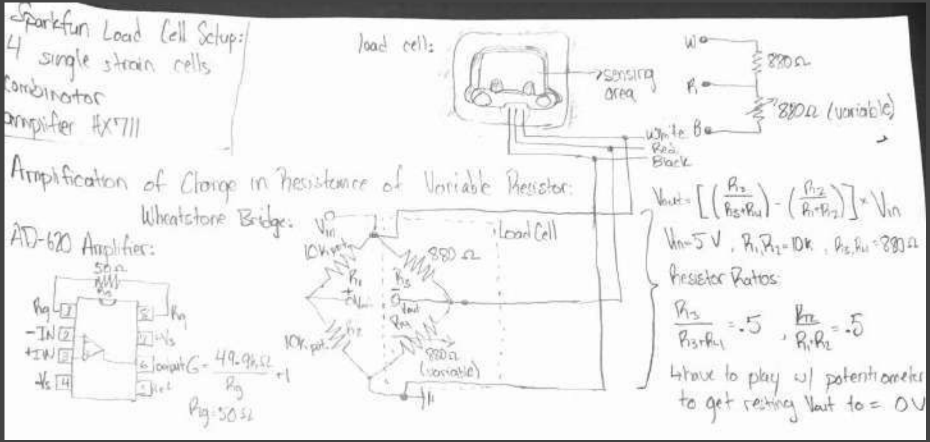


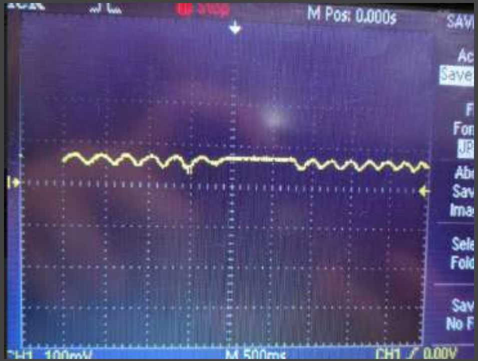
Objective: To design a system that uses an EOG and
EMG signal to read the differences in intentional and
unintentional blinking to allow those with disabilities to
control with the environment around them.

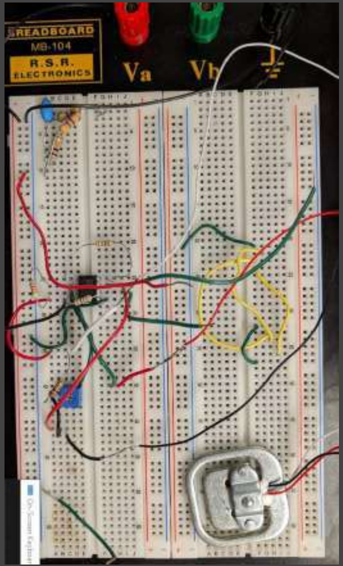


Intelligent Balance Board for Ankle Injury Prevention/Rehabilitation

- 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







Reflectance vs. Transmittance Photoplethysmograms on Various Locations for Heart Rate Monitoring

Goal:

Compact PPG for mobile monitoring

Compare different locations to find most accurate sensor

Method:

Create two PPG sensors (Transmittance & Reflectance)

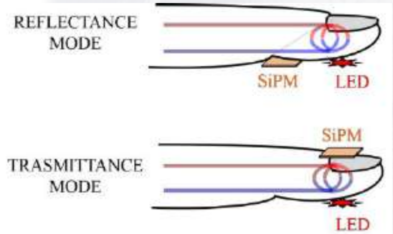
Take measurements from 5 locations

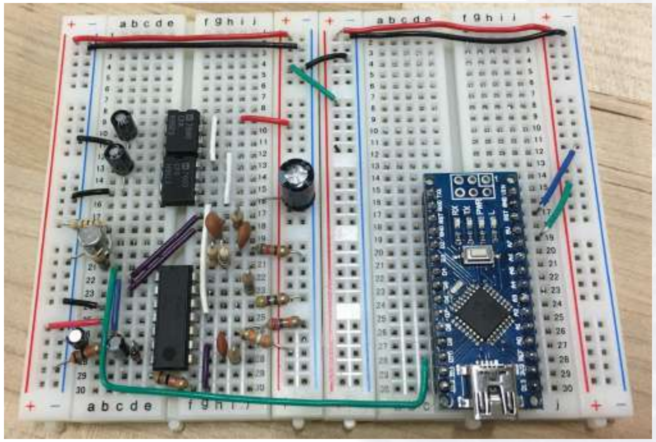
Findings:

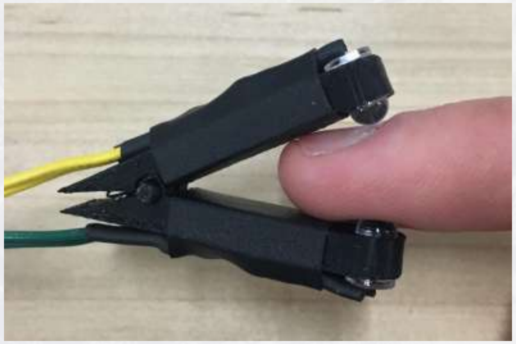
Transmittance = 5.49% Error

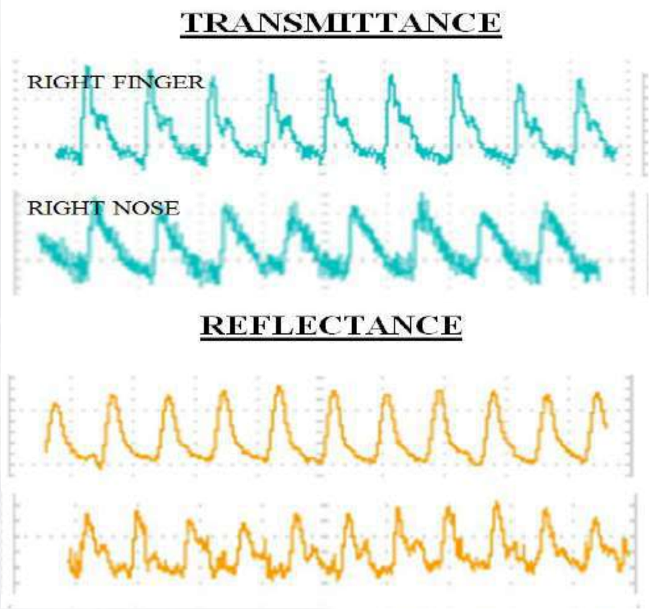
Reflectance = 3.76% Error

Left Ear = 2.06% Error









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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

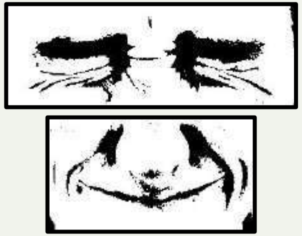
1. Integrated each sensor (ambient temperature, glove temperature, and pressure sensor) with the arduino as well as the OLED screen. (COMPLETE)
2. Obtain the temperature reading from the infrared camera. Display that information on the OLED HUD, as well as transmit that data via bluetooth through our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

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

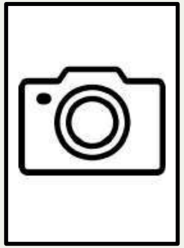
Rachel Bellisle, Jessika Decker, and John McLinden

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



Template Images

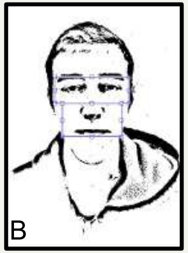


Take an Image

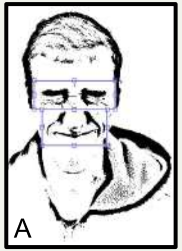
Adaptive Threshold Binary Filter

New Image

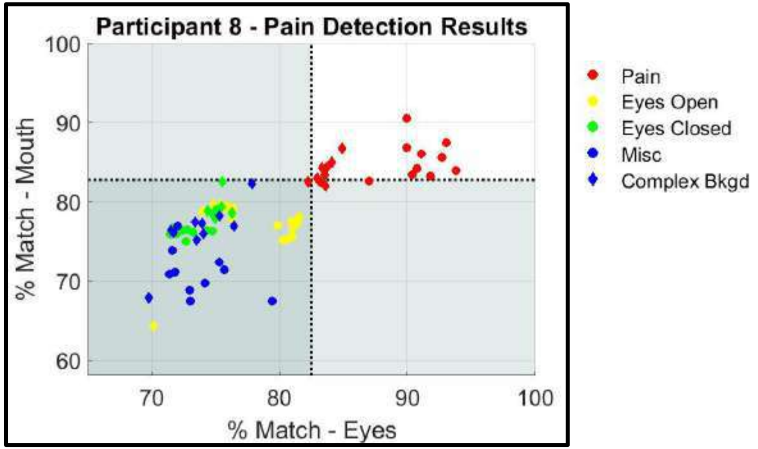
Cross Correlation



% match eyes = 81.30
% match mouth = 76.59



% match eyes = 95.88
% match mouth = 93.04



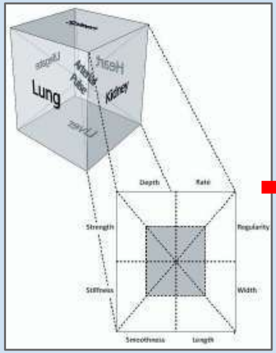
Participant	P1	P2	P3	P4	P5	P6	P7	P8
% True Positives	100	90	100	10	90	90	100	90
% False Positives	0	0	0	30	0	0	57	0

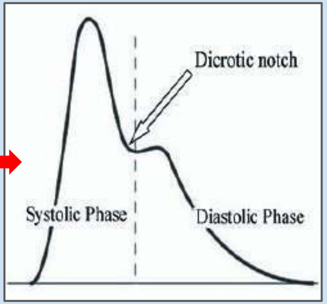
Wrist Pulse Simulation Technology Capable of Representing 28 Pulse Patterns of Traditional Chinese Medicine

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.



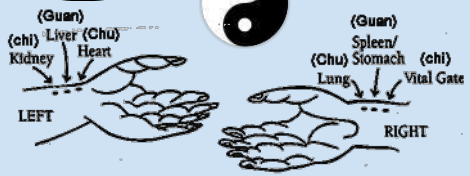


Background Information

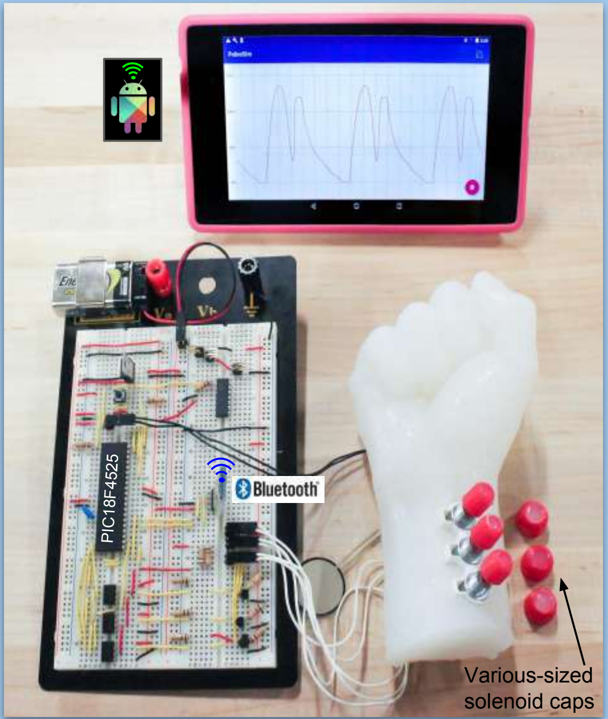
Qi - vital energy

Yang - health

Yin - disease

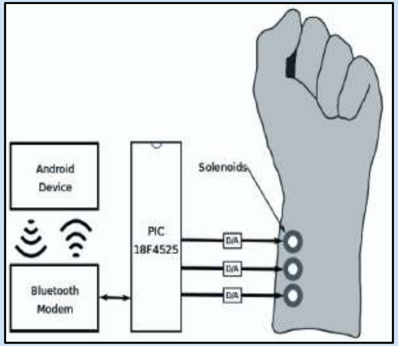


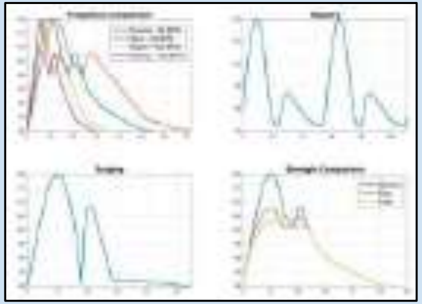
Results



Methods

Hardware Implementation





Manipulation of Radial Pulse Waveform

MagnetPeutics

Wearable Rotating Permanent Magnets Driven by Brushless Motor for Rehabilitating Stroke Patients

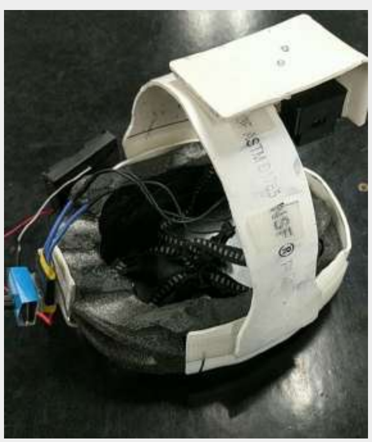
Austin Ramos
Zachary Brown
Juan Malvar

Objective:

To make Transcranial Magnetic Stimulation more accessible to stroke victims.

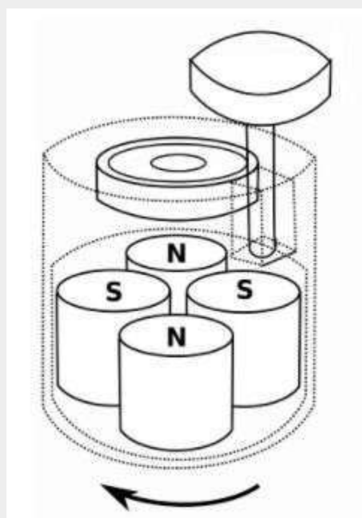
Plan:

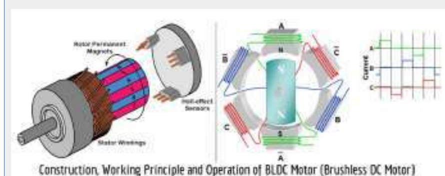
To make a helmet with permanent magnets that are rotated to induce an electric field to stimulate a patient's brain cells that were affected by a stroke.



Methods:

The helmet design consists of a framework as well as a magnet housing. The permanent magnets used are two thirds Tesla strength N52 Neodymium magnets with half-inch diameter and half-inch depth.





A DC brushless motor spins adjacent to the magnet unit which rests on a ball bearing, rotating it by friction.

Results:

Rotational velocity	Noise level increase
1490 rpm	+12.7dB
3500 rpm	+18.3 dB
4550 rpm	+20.0 dB

Model House for Assisted Living

Amy Harmon, Ahmaad Randall, and Alexis Welch

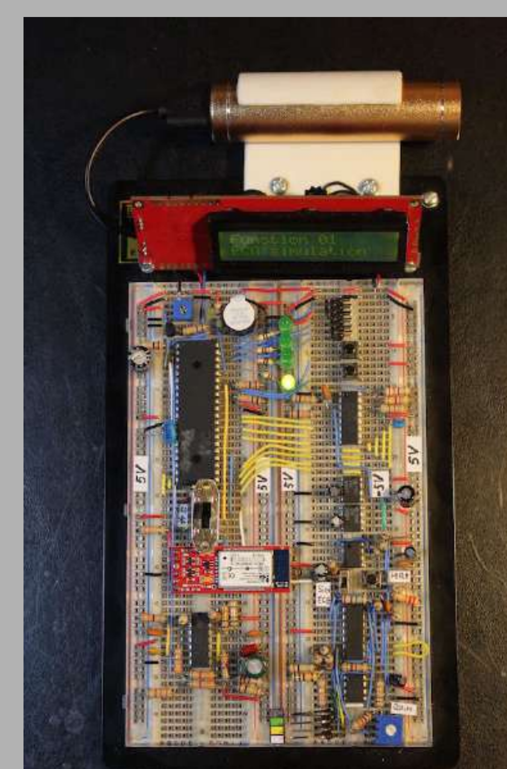
OBJECTIVES

- 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.

←



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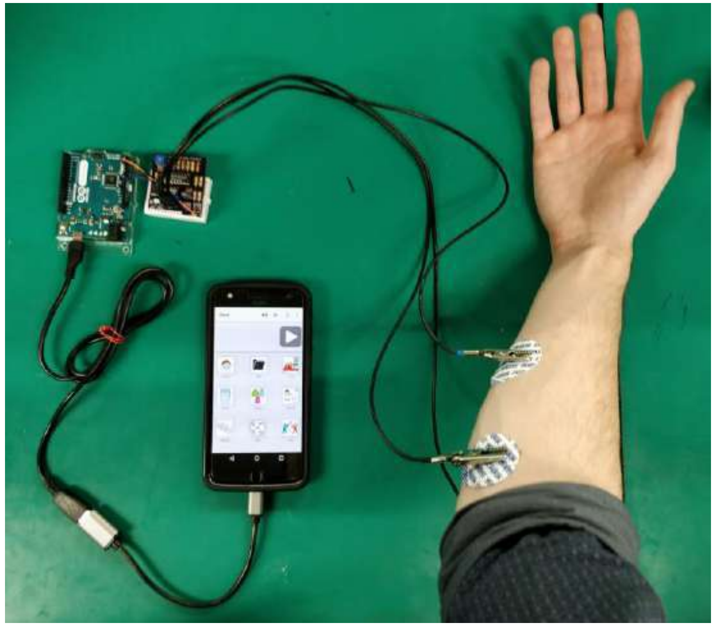
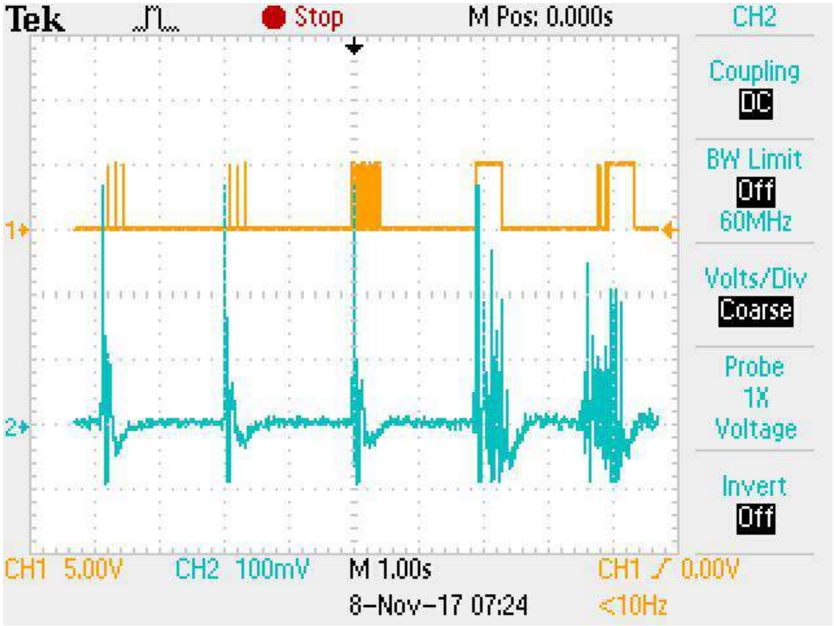
Alternative Augmented Communication

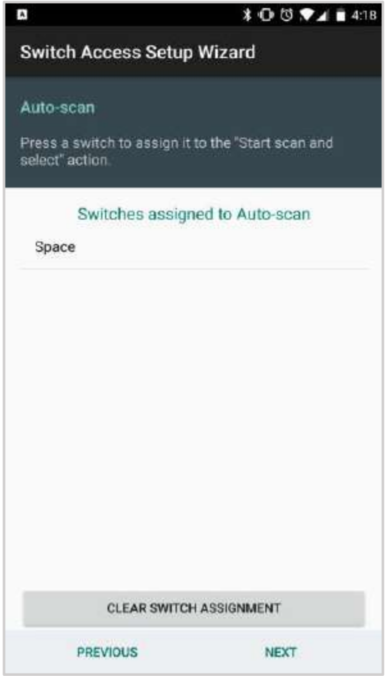
Communication solutions utilizing electromyographic sensors and Android Accessibility



Hardware Setup

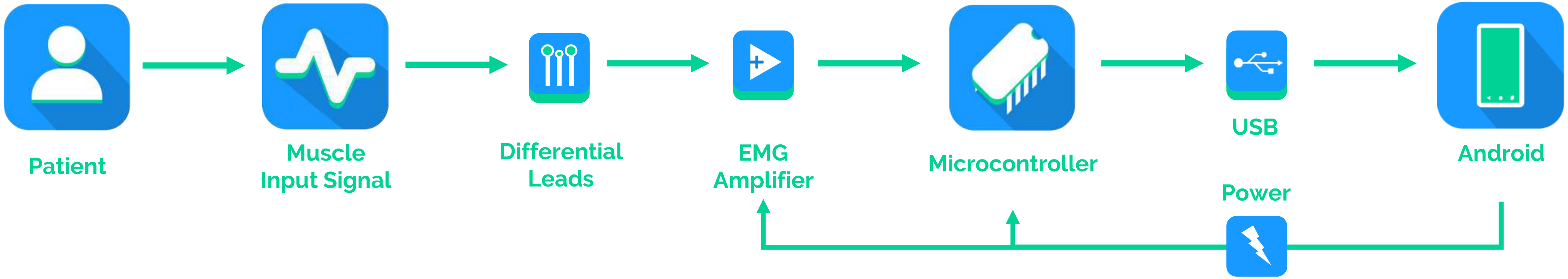


Scope – Channel 1 MOBD – Channel 2 EMG Signal



Android Accessibility

LetMeTalk



Josh Harper & Zach DiMartino

Assisted Self Treatment for Dysregulation of Emotions Based on Biofeedback

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