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Medical Need

- Parkinson's Disease
- 10 million
- \$60,000+
- Therapy maintains physical function

Objective

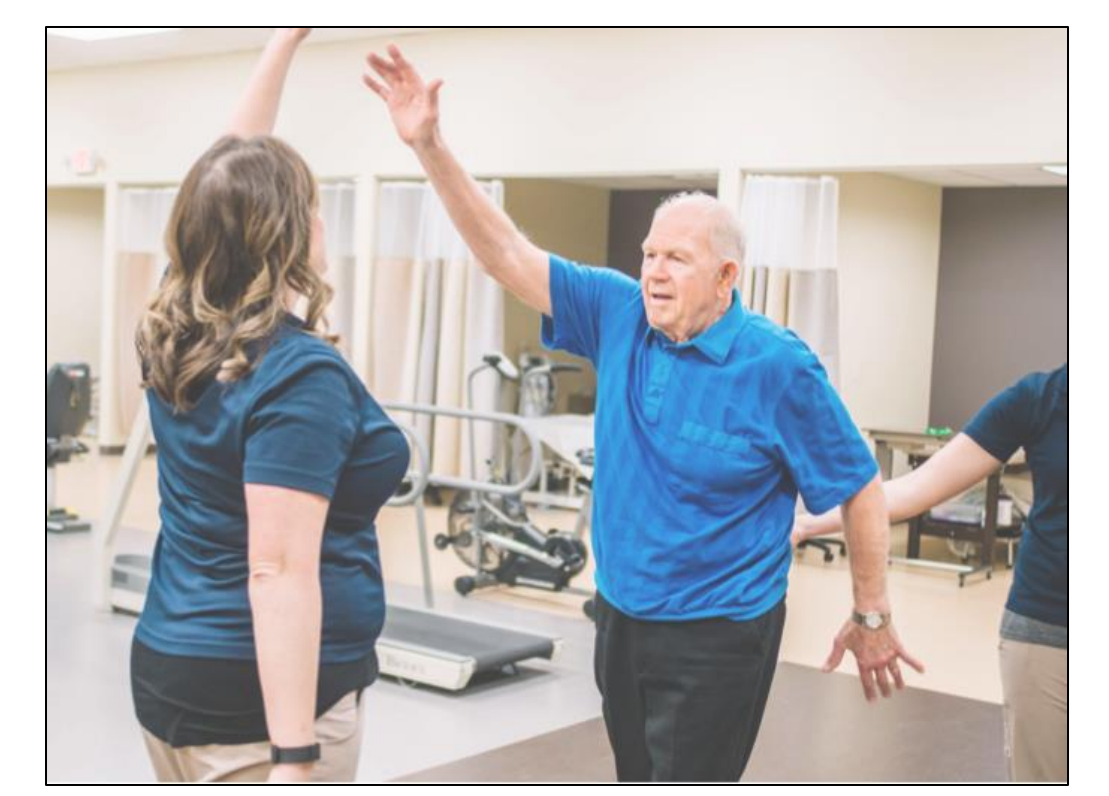
A wearable device for Parkinson's Disease patients that allows them to perform LSVT BIG therapy on their own with instantaneous feedback system that also relays information back to therapists.

Existing Solutions

LSVT BIG (Lee Silverman Voice Treatment - BIG) is an intensive physical therapy for PD patients to help increase strength of the entire body and slow down PD progress.

*PD = Parkinson's Disease

Existing Solutions #1
Standard in-person LSVT BIG Therapy session

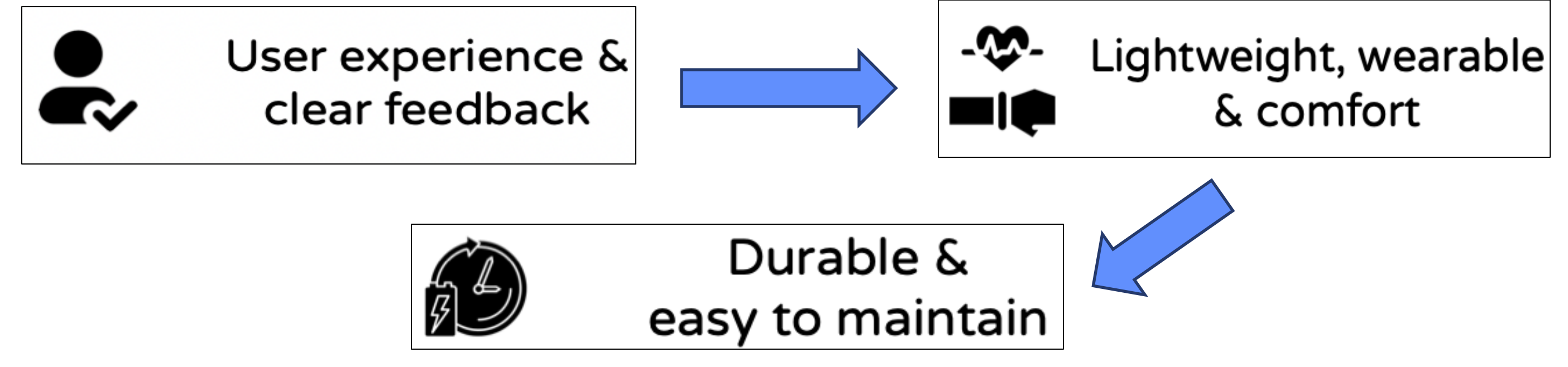


Existing Solutions #2
Telehealth/ Virtual Sessions

Existing Solutions #3
Smart Watches

Design Inputs

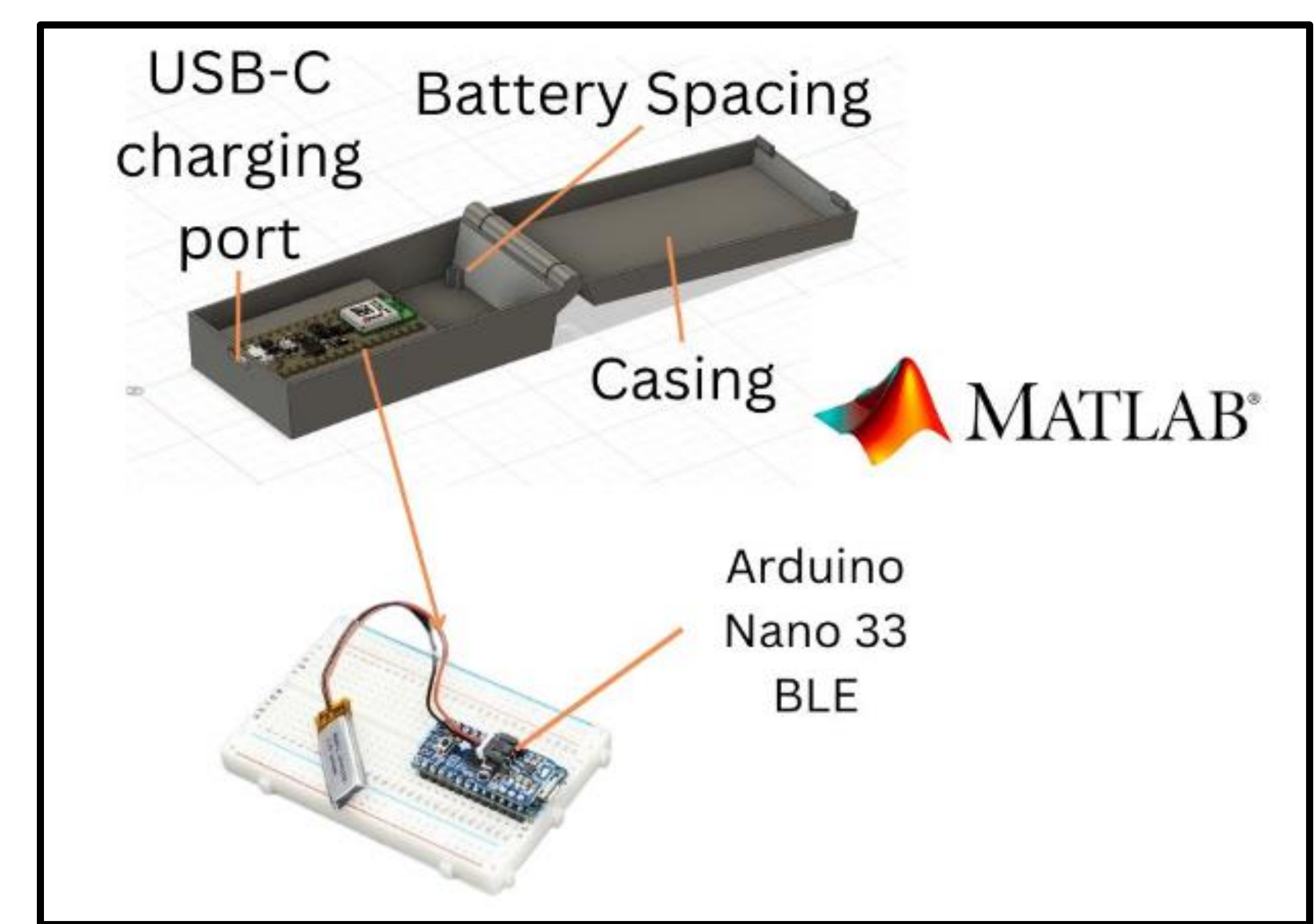
Constraints



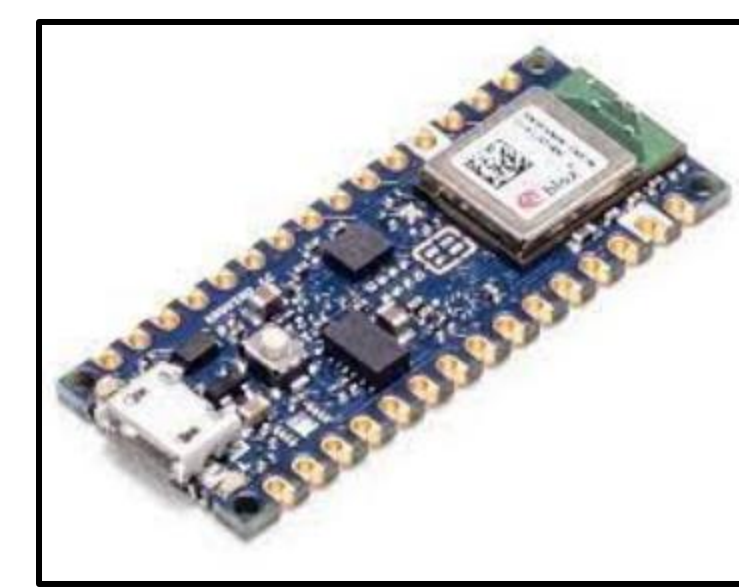
Requirements

- Range of Motion**
 - Shoulder abduction/adduction
 - 0 - 150 degrees
- Velocity**
 - Measure the velocity of movement (m/s)
 - Fast, dynamic motion
 - Slowed, controlled movement
- Feedback Mechanism**
 - Provide feedback for both therapists and patients
 - Instant or minimal lag
 - Clear and discernible

Prototype



Motherboard
 Arduino Nano 33 BLE: measures movement
 Adafruit battery: voltage regulation & charging (USB-C)
 Lithium Ion Battery: external battery source



Casing
 3D printed casing: encases components
 Velcro straps: attaches to subject wrist

Code
 MATLAB code: designed by the team, the code collects data through MATLAB

Solution & Verification

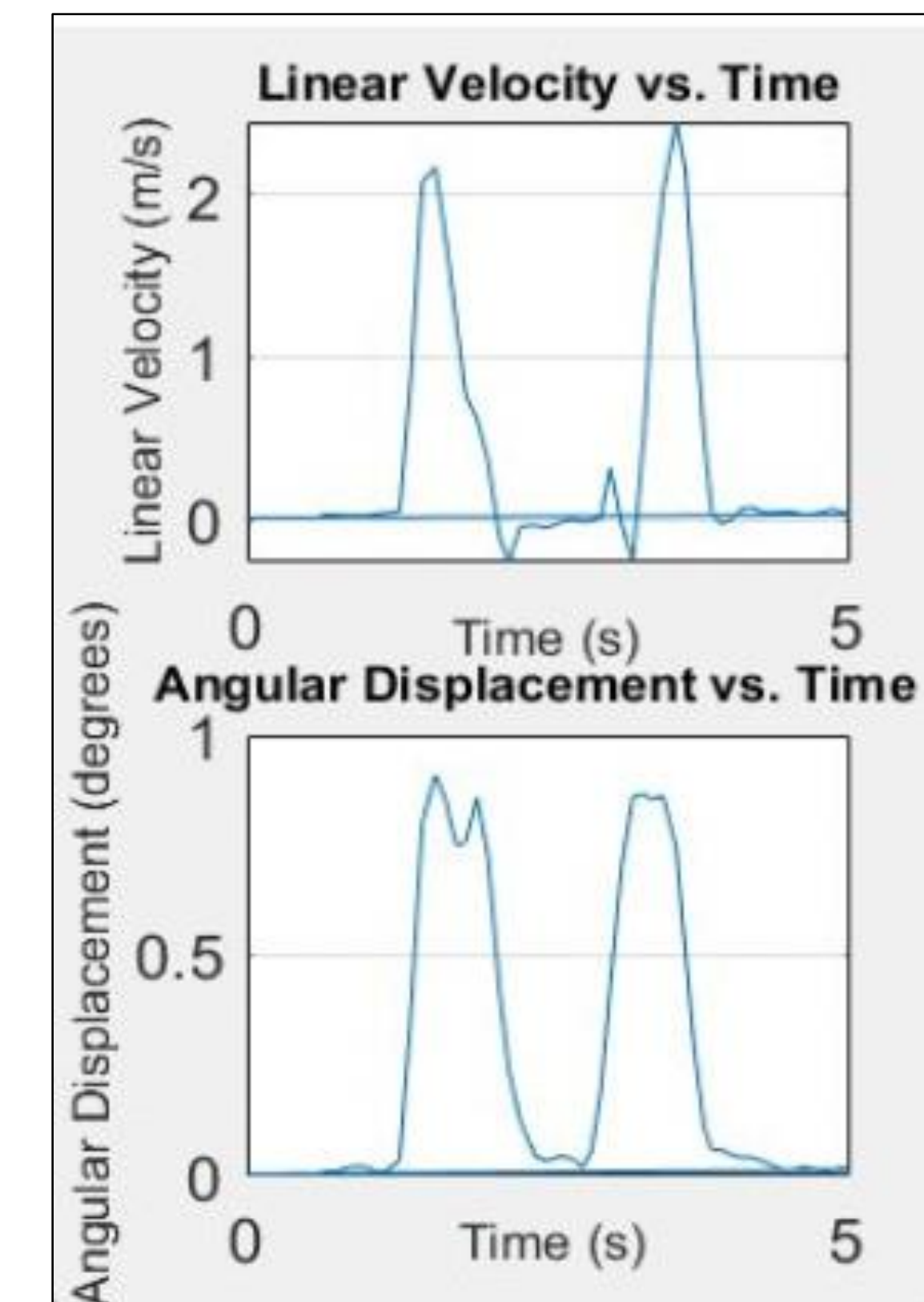
PERFORM
shoulder abduction & adduction

MEASURE
movement with Arduino IDE

TRANSLATE
with MATLAB code that team developed readable data

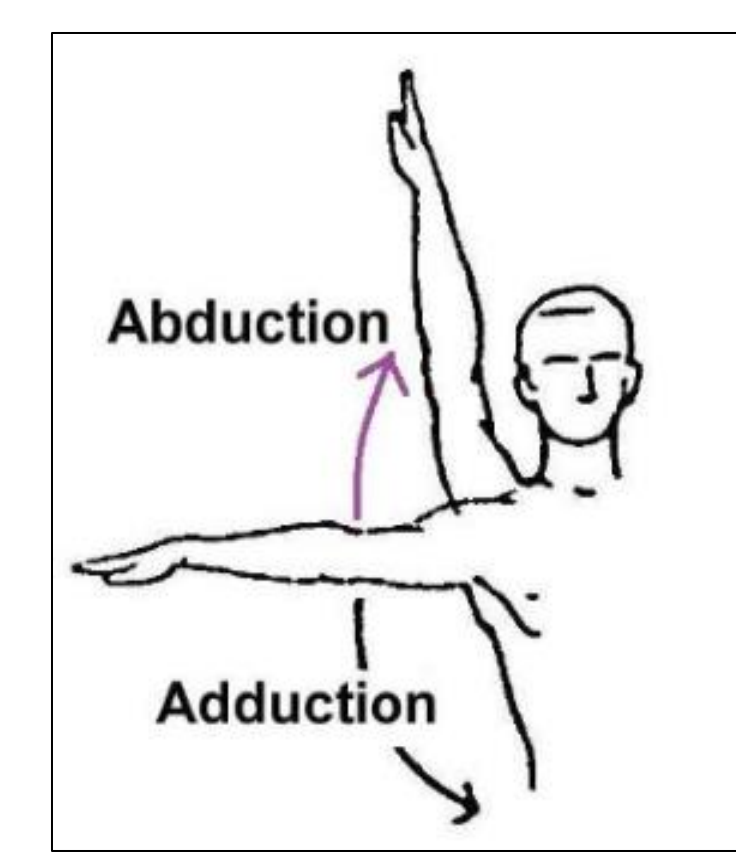
LOG
the data for therapists and patients feedback

Verification/ Validation



(1) Linear Velocity & Angular Displacement

- Comparison of pre-determined movement & data display
- Use of supplemental rotational arm that mimics human shoulder
- 0.05 significance one-sample t-test



(2) User Feedback

- Time (ms) to display information or feedback after each action
- Average of 10 repetition under 1000 ms deems the test to be successful

Conclusion and Impact

(1) In Progress
 *Verification testing
 *Reduction of device size
 *Search for quantifiable data

(2) Innovation
 *Incorporation of Inertial Measurement Units
 *Instantaneous feedback

(3) Impact
 *Less obstructive, affordable, durable, accessible for LSVT-BIG therapy

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