

aliviArÁ

HACK FOR HUMANITY

Dino Digma

Tomás Vega

Corten Singer

Ghassan Makhoul

Alejandro Castillejo

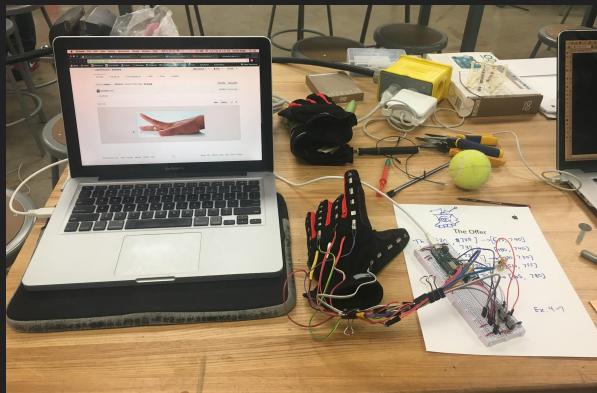
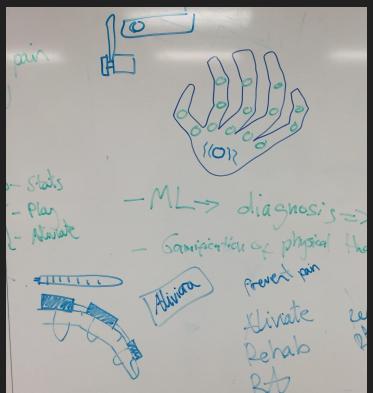
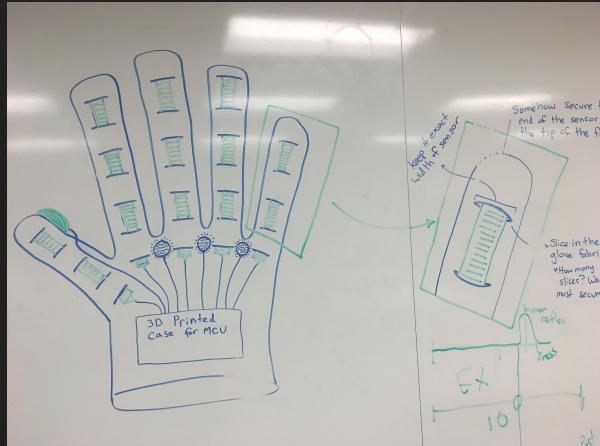
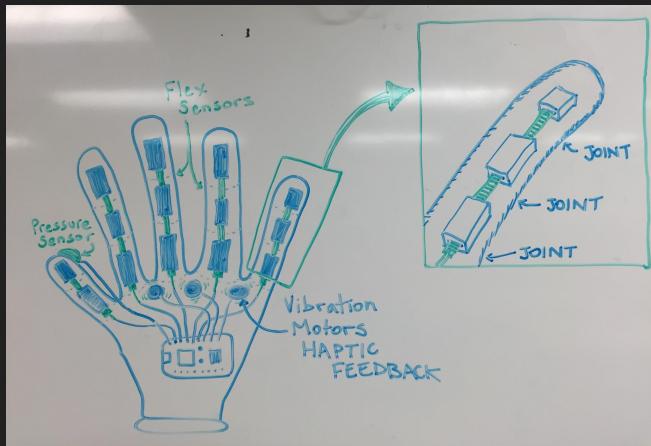
How can we improve
the life of someone
suffering from
Rheumatoid Arthritis?

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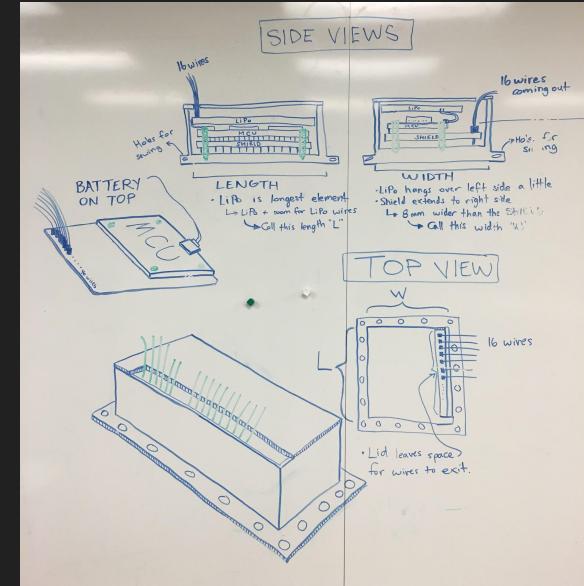
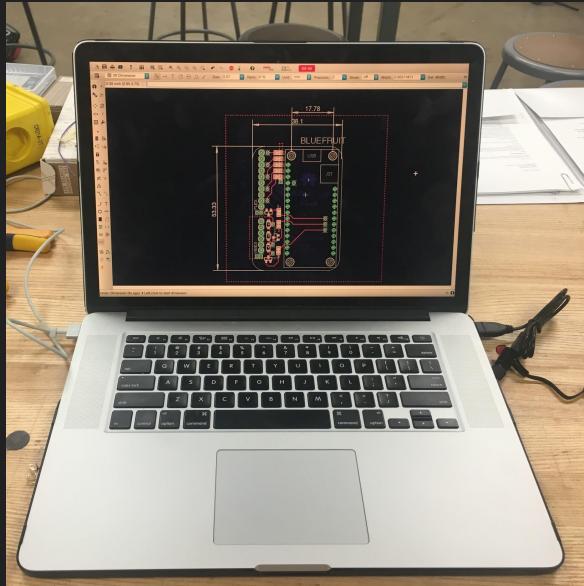
An integrated system aimed to
help those with arthritis **alleviate**
daily pain & rehabilitate joint
flexibility

- Smart Glove Sensor
- Real time iOS application
- Flask server + data storage
- Automated report system

Design Process

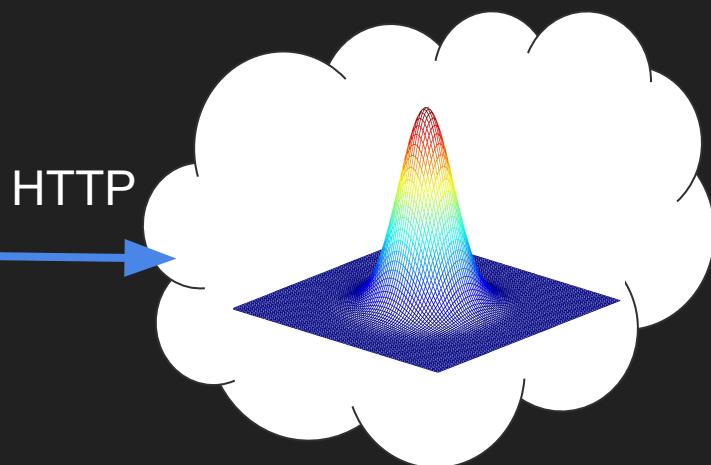
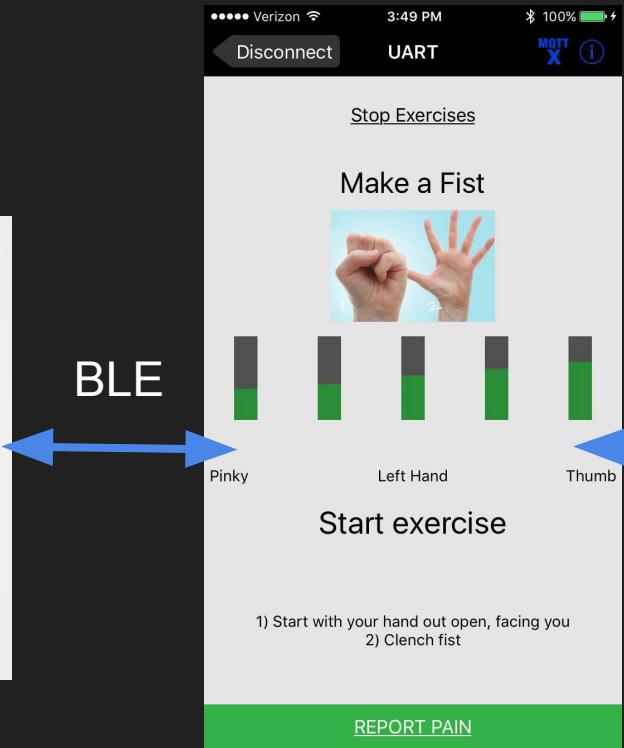
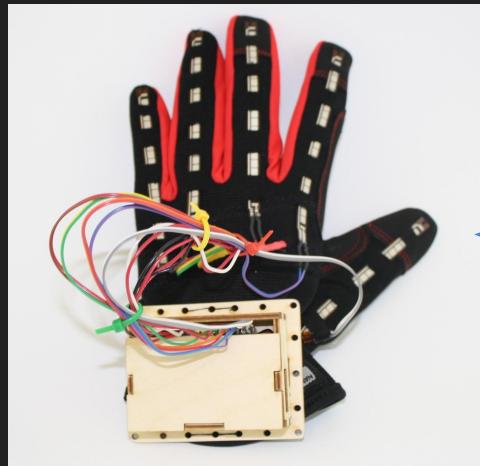


Design Process



Final Prototype

Infrastructure

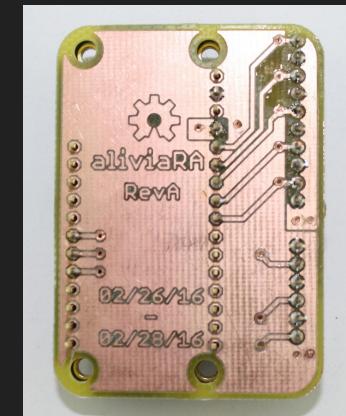
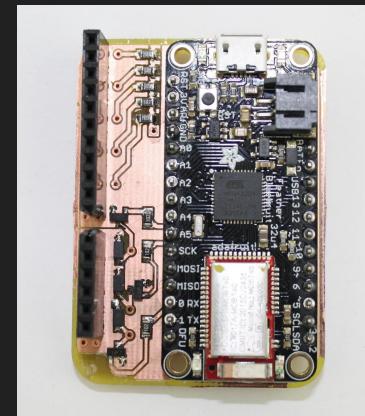
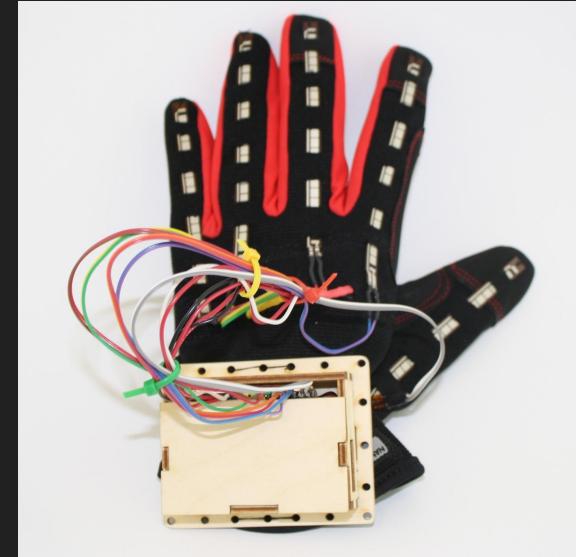


BLE

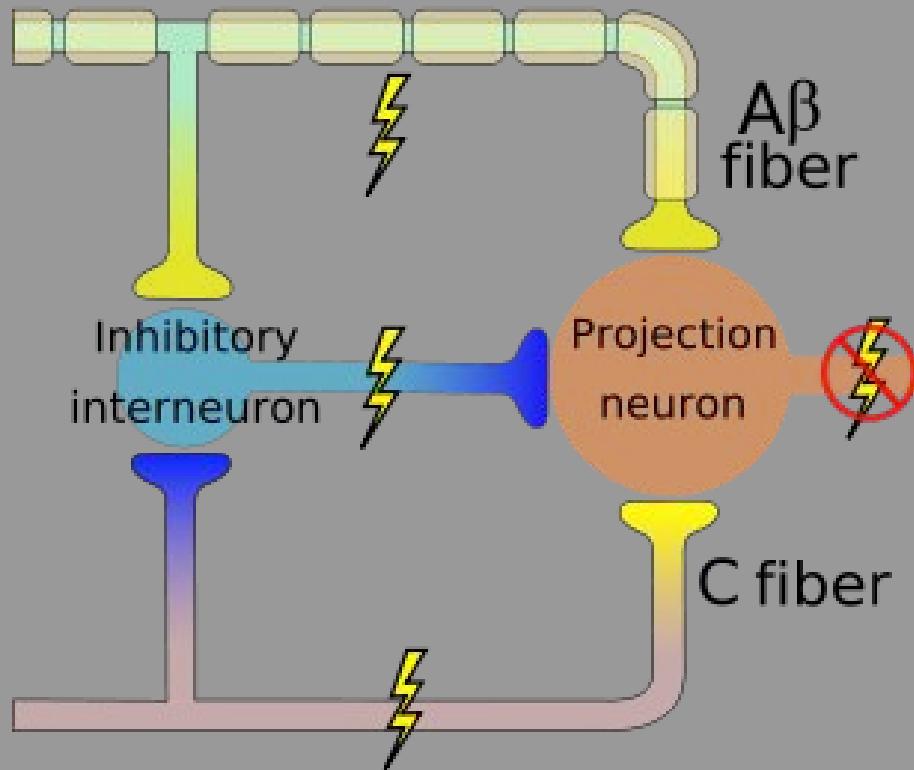
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Glove

- 5 Flex sensors + 3 Vibration Motors
 - Bluetooth LE microcontroller
 - Exercises with Flex values
 - Send real time finger position data
 - Receive haptic feedback & massage therapy from the iOS app
 - Arduino Sketch program
 - Custom-made PCB
 - Laser-cut housing

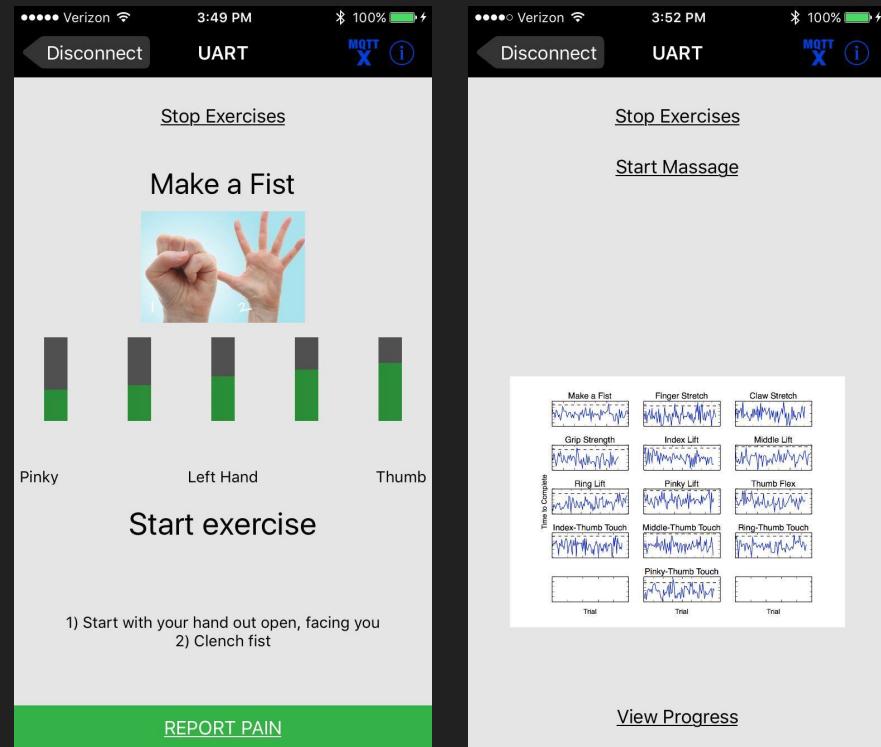


Massage Mode: Hacking the Nervous System

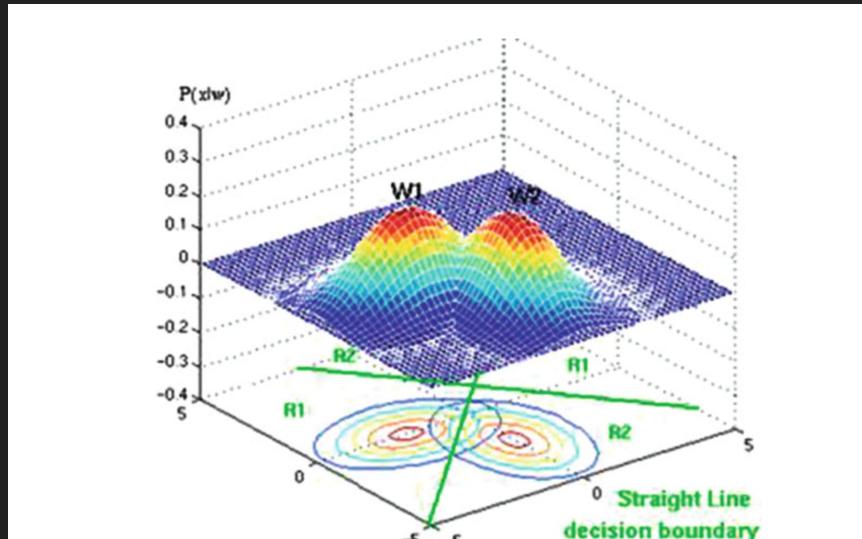


iOS Application

- Exercise Mode
 - Receives real-time feedback data from the smart glove
 - Purpose: Run through a series of hand-positioning exercises known to target weak joints, and provide feedback
- Massage Mode
- Progress analysis
 - Connect with doctors



Flask Server + Machine Learning



We use quadratic discriminant analysis to learn the Gaussian distribution of arthritic events, and classify based on the maximum likelihood estimation

This gives us insight on arthritic events, and more accurately tailor the exercise to the user's limitations

We can expand on this by detecting changes in the distribution over time

Automated Response Service

- Detection of progression of Rheumatoid Arthritis
- Sends data to doctor with scores of different exercises
- Helps identify specific hand positions and tasks that cause most severe pain

aliviara420@gmail.com 1:29 PM (1 hour ago)   

to me 

Hello:

We have been recording performance on hand exercises from Chance the Rapper. The data is suggesting that their performance on some exercises is degrading, which may be early signs of Rheumatoid Arthritis.

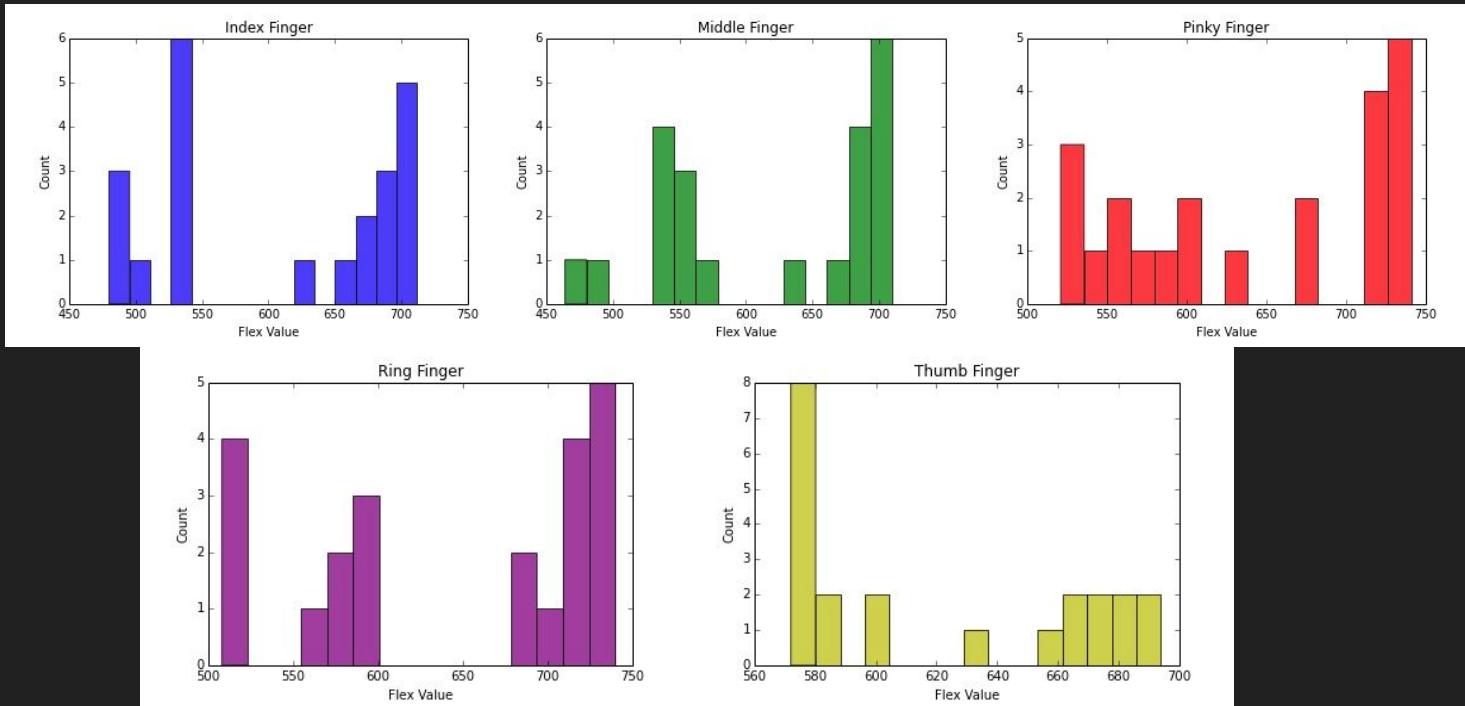
The exercises that Chance is failing to complete at the standard of healthy controls is Exercise 0. The instructions for these tasks can be viewed below and a schematic of the exercise is attached to this message.

Exercise - Make a Fist 1) Start with your hand out open, facing you 2) Clench fist

Best,
The Aliviara Team



Progress Analysis



future steps & impact

Design Improvements

- More complex sensor system
 - 1 sensor per knuckle
 - User bio-feedback for better diagnostics (thermometer sensor)
- More extensive haptic feedback library
- Boot up calibration for user specific customization
- Different glove sizes
- Increase engagement by gamifying app
- Include therapy during sleep in order to prevent morning stiffness

Impact

- Not only useful for RA symptoms
 - Stroke, Multiple Sclerosis
- Personalized physical therapy with updates to your doctor
- Convenient BT/Cloud platform

demos