**Docket #:** S21-005

# Wearable Optical Sensor System for Musculoskeletal Movement

A Stanford bioengineering researcher developed an optical sensor based muscle and body motion tracking system for use with prosthetics and wearable human machine interfaces. Current electromyography (EMG) sensor based devices suffer from high signal-to-noise issues, skin-electrode impedance mismatch, latency, and motion artifacts. The optical sensor based system overcomes these issues. Readily available inexpensive optical sensors measure forward and back-scattered light from the skin. Machine learning processes signal changes to detect movement, and translates motion into discrete or graded analog control outputs that can be readily used for augmented or virtual reality systems, high degree-of-freedom prosthetics, exoskeletons, computing devices, and activity monitoring.

**Video - Proof of Concept hand gesture training and classification**
(Media courtesy Tyler Chen)

**Stage of Development – Proof of Concept**
Tyler Chen successfully tested hand and leg tracking with users of wide-ranging skin tones. With the system as-implemented, prosthetic or exoskeleton hand control is feasible. Work is ongoing to test and improve designs (including other embodiments like a virtual keyboard), control paradigms, and real-world robustness. Final design will use custom printed circuit boards to drastically reduce device footprint and improve robustness, static and/or dynamic flex PCBs, external enhancements, and other wearable electronics advancements.

## Applications

- **Motion tracking** for **virtual** or **augmented reality** devices
- **Wearable computing interface**:

    - Limbless typing/computing input
    - Gesture/pose-based controller
- **Exoskeleton/robotic manipulator** control interface
- **Prosthetics**
- **Wearable rehab/physiological monitoring** of muscle activation and connective tissue motion

## Advantages

- **Accurate, robust, and reproducible**
- **Minimally obtrusive**
- Fabricated with **readily available, inexpensive sensors**
- **Reduced latency and motion artifacts**, and **free from impedance mismatch** associated with EMG based sensing

## Innovators

- Tyler Chen
- Nicholas Melosh
- Junrui Yang
- Savannah Cofer

## Licensing Contact


### David Mallin

Licensing Manager, Physical Sciences

Email