PURE MOTOR MONOPARESIS UPPER LIMB ASSISTIVE EXOSKELETON

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PURE MOTOR MONOPARESIS (PMM)

Isolated motor deficit after stroke

- Precentral gyrus lesion/acute cerebral infarction (Hiraga, 2011)
- No sensory or coordination dysfunction (Hiraga, 2011)

Single limb affected

- Upper limb prevalence of 2.6% of stroke victims (Maedar Ingvar et al., 2005)

Existing Solutions

- Designed for rehabilitation rather than daily living assistance (Patoglu, 2017; Deshpande & Kim, 2019)

Deshpande, A., Kim, B. (2019). Upper-Body Robotic Exoskeleton (U.S. Patent No. 10,463,560). U.S. Patent and Trademark Office.
Hiraga A. (2011). Pure motor monoparesis due to ischemic stroke. The neurologist, 17(6), 301–308.
Maeder-Ingvar, M., van Melle, G., & Bogousslavsky, J. (2005). Pure monoparesis: a particular stroke subgroup? Archives of neurology, 62(8), 1221–1224.
Patoglu, V. (2017). Exoskeleton (U.S. Patent No. 20,120,330,198). U.S. Patent and Trademark Office.

DESIGN CONTROLS

USER NEED	DESIGN INPUT	DESIGN OUTPUT
Normal Elbow ROM	-5°-146° extension/flexion	Goniometer measurement of elbow joint
Comfort	User routinely wears device up to 3 times per week without complaint of discomfort or pain	User comfort survey & frequency of use/compliance statistics
Accurately read EMG signal	Correctly identify signal corresponding to intent to flex elbow	Test 10 reps intending to lift & 10 reps not intending to lift
Secure attachment to elbow	<1mm shift in securement position(s) per cycle of extension/flexion	Measurement of initial position of securement relative to elbow and measurement after full ROM cycle

SOLUTION

Arm Brace

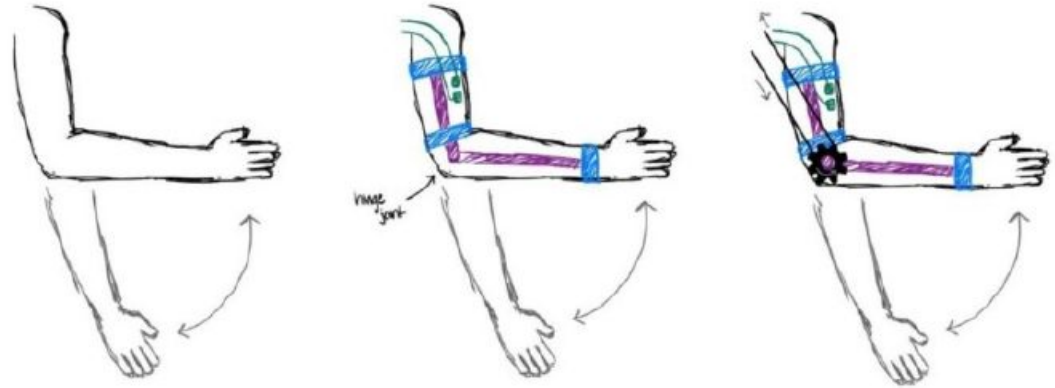
- Aluminum bars secured to arm with Velcro
- Hinge point secured with nuts & bolts

Flexion/Extension Motion

- Gear attached to hinge point of elbow
- Pulley system between gear and motor
- EMG signal activates motor to turn

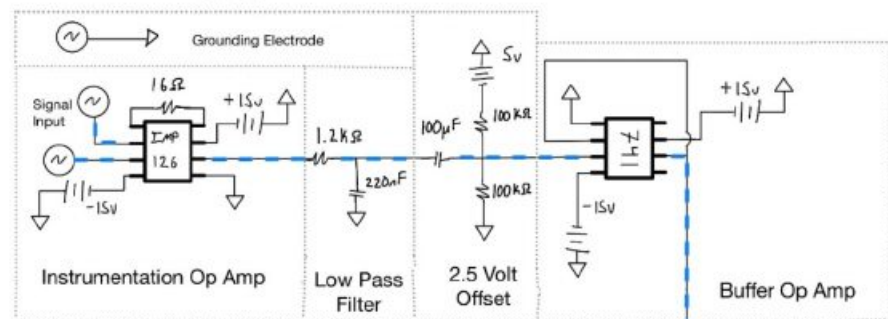
Harness

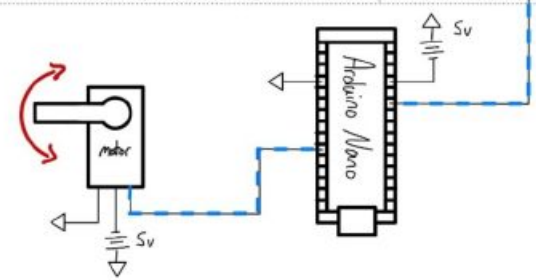
- Motor and power supply secured with harness



- velcro
- metal
- EMG electrodes
- servo
- harness

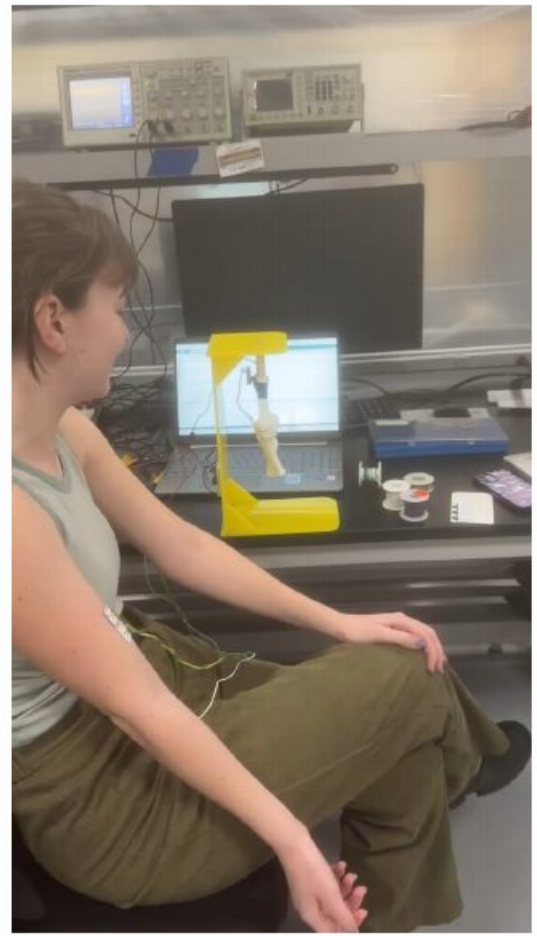
back/posterior view

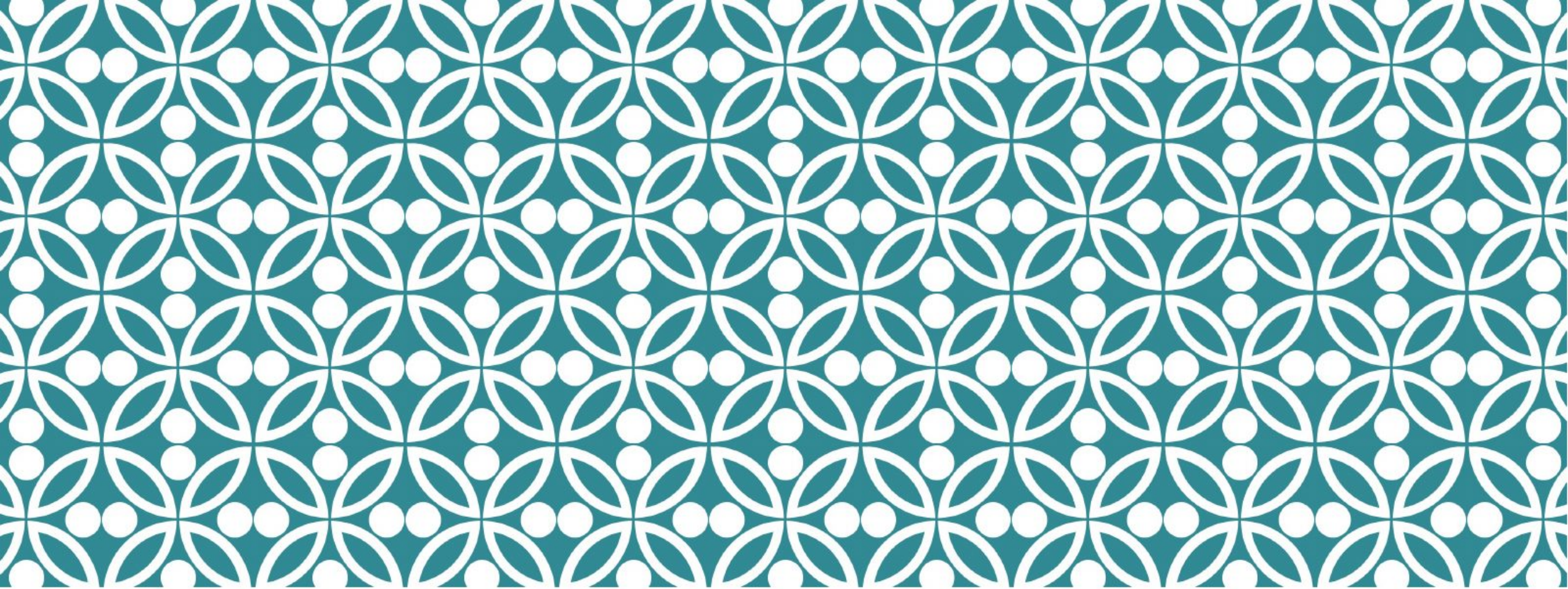




VERIFICATION

- Device tested with 2 users
  - Successful servo motor activation/operation (flexion when bicep flexed, extension when relaxed)
  - Easily adjustable between users





QUESTIONS?