Wearable Haptic Sensory Prosthesis for Proprioception

spatial summation of localized pressure for prosthesis design

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Touch & proprioception are vital
but a host of diseases disrupt it

stroke
diabetes
amputation
piezo2 loss of function (LOF)

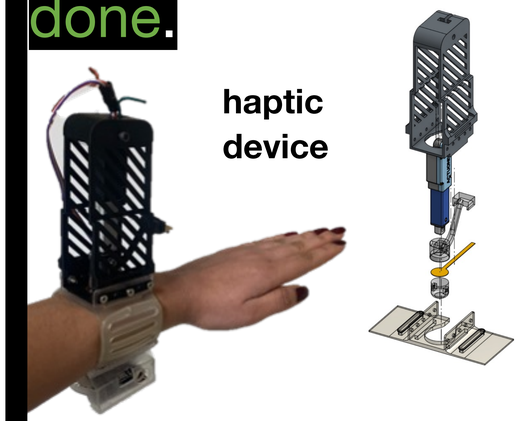
piezo2 LOF causes debilitating impairments

no proprioception, light touch vibration sense
yes pain, **deep pressure,** temperature,

A sensory prosthesis that provides **substitutive haptic feedback** is a viable solution.

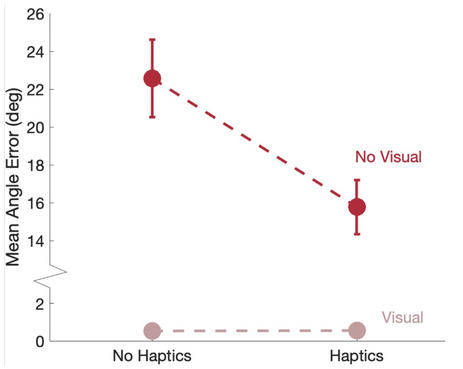
part 1: can localized pressure be used as feedback?

done.



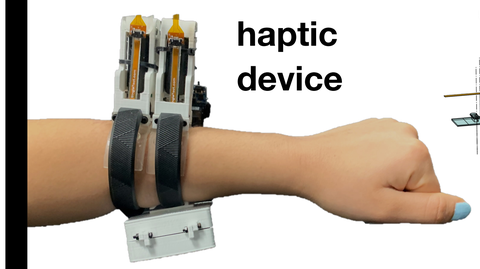
user study

results

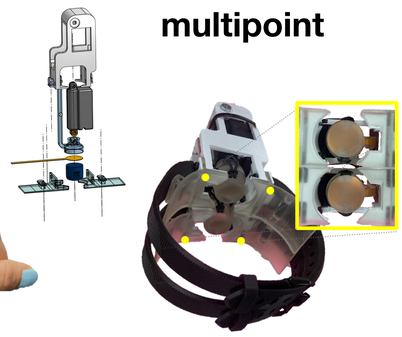


part 2: how do we interpret multiple points of pressure?

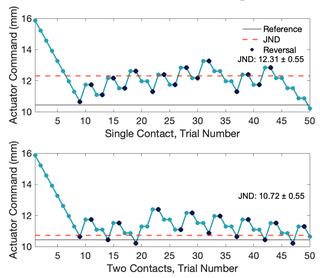
in progress.



multipoint



jnd staircasing test



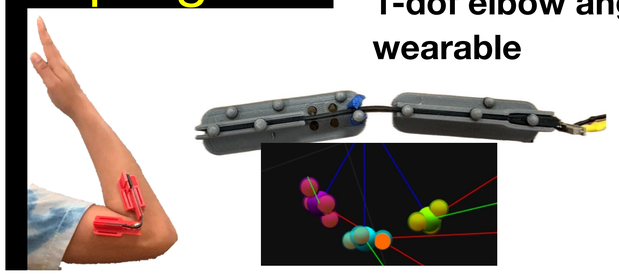
Next Steps

- force control device
- ordering pairs of stimuli on continuum

part 3: let's build & test prosthesis with piezo2 LOF patients.

in progress.

1-dof elbow angle wearable



prototype

Next Steps

- use part ii to inform mappings
- work with NIH for clinical trials

References

S. Kodali et. al. "Wearable sensory substitution for proprioception via deep pressure," in 2023 IEEE World Haptics Conference (WHC), 2023, pp. 286–292.
A. T. Chesler, et. al. "The role of piezo2 in human mechanosensation," New England Journal of Medicine, vol. 375, no. 14, pp. 1355–1364, 2016