

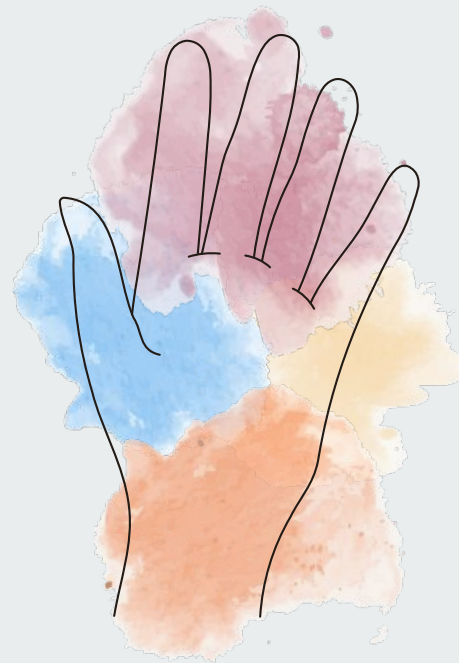


**Giving back motion through voice**

23-25 April 2025

Lausanne EPFL

Lemanic Life Sciences Hackathon



# The Problem

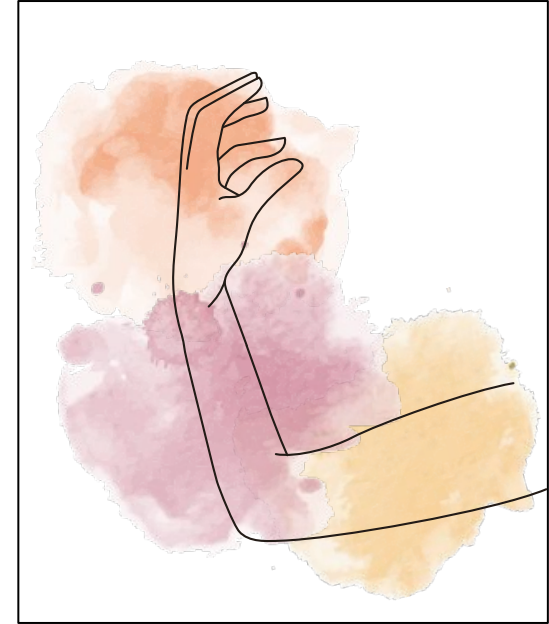
15 M

People living with Spinal Cord Injury (SCI), which can lead to partial or complete loss of hand motor function. [1]

*“The top priority for patients affected by SCI is regaining hand functions” [2]*

[1] Wu, A. M., et al. (2023)

[2] Anderson, K. D. (2004)



# The Problem

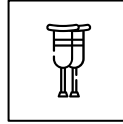
Grasping is essential for daily life and independence [1].

Nervous system damage can impair this ability [2].



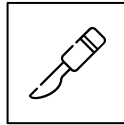
- [1] Y. Liu et al. 2021
- [2] A. Renne, J. A et al., 2023

# Current solution



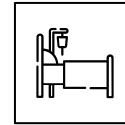
## Brain-Computer Interface

Complex, experimental,  
invasive



## Surgery

Risky, irreversible, very  
expensive



## Physical Therapy

Slow, limited recovery

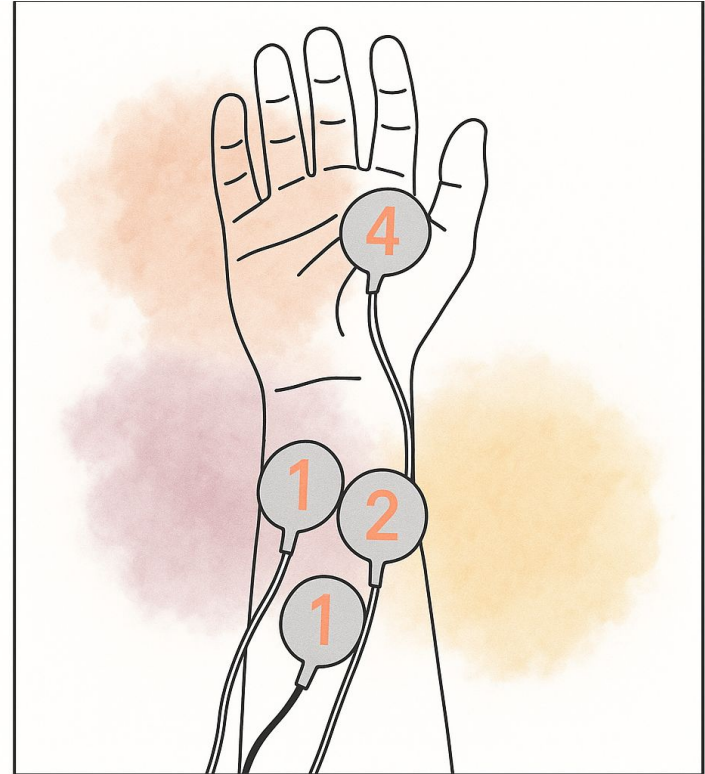
# Functional Electrical Stimulation (FES)

Stimulation of muscles using electrical pulses [1]

Restoration of impaired motor functions [2]

[1] V. C. K. Cheung et al., 2019

[2] A. Biasiucci et al., 2018



# Intention Recognition in FES



## Current Solutions

- Muscle (EMG) and brain (EEG) signals [1]
- Motion signals [4, 5]

## Challenges

- Instability in intention decoding [2, 3]
- Limited application in real-world scenarios

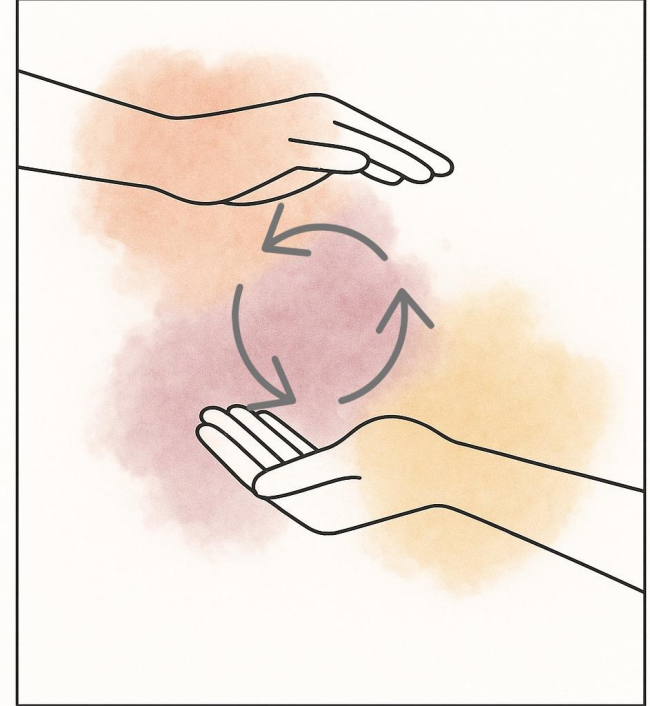
[1] S. C. Colachis IV et al., 2018  
[2] S. Miura et al. et al., 2021

[3] T. Alif et al., 2023  
[4] C. Lin et al. 2025

[5] R. Cornwall et al., 2004

# Closed-Loop Stimulation

- Traditionally, rehabilitation therapies use fixed electrical currents [1]
- Adaptation with sensory feedback is crucial [2, 3]

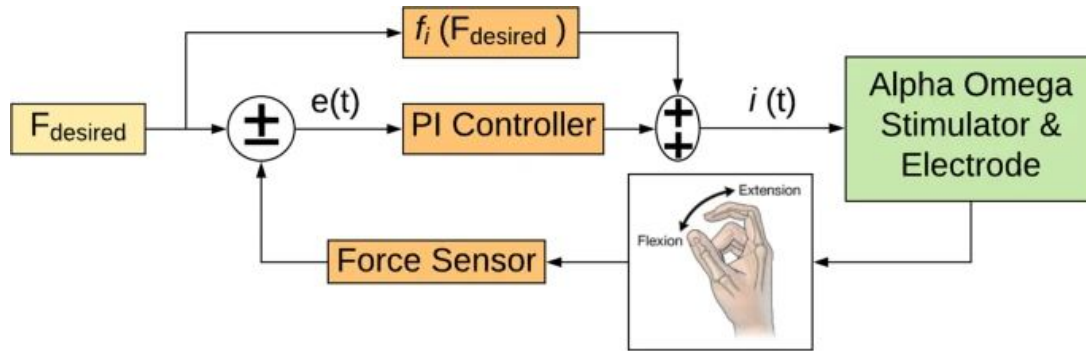


[1] M. A. Khan et al., 2023

[2] C. Lin et al. 2025

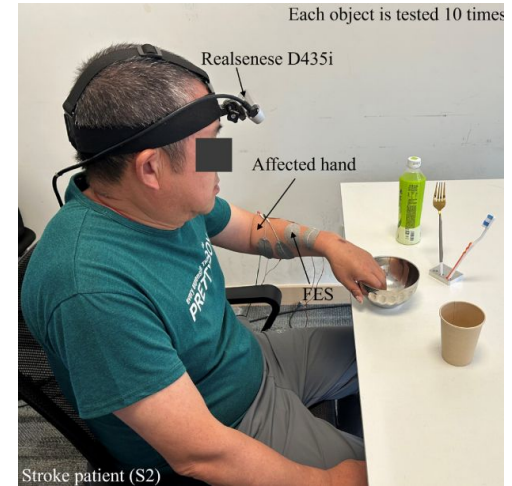
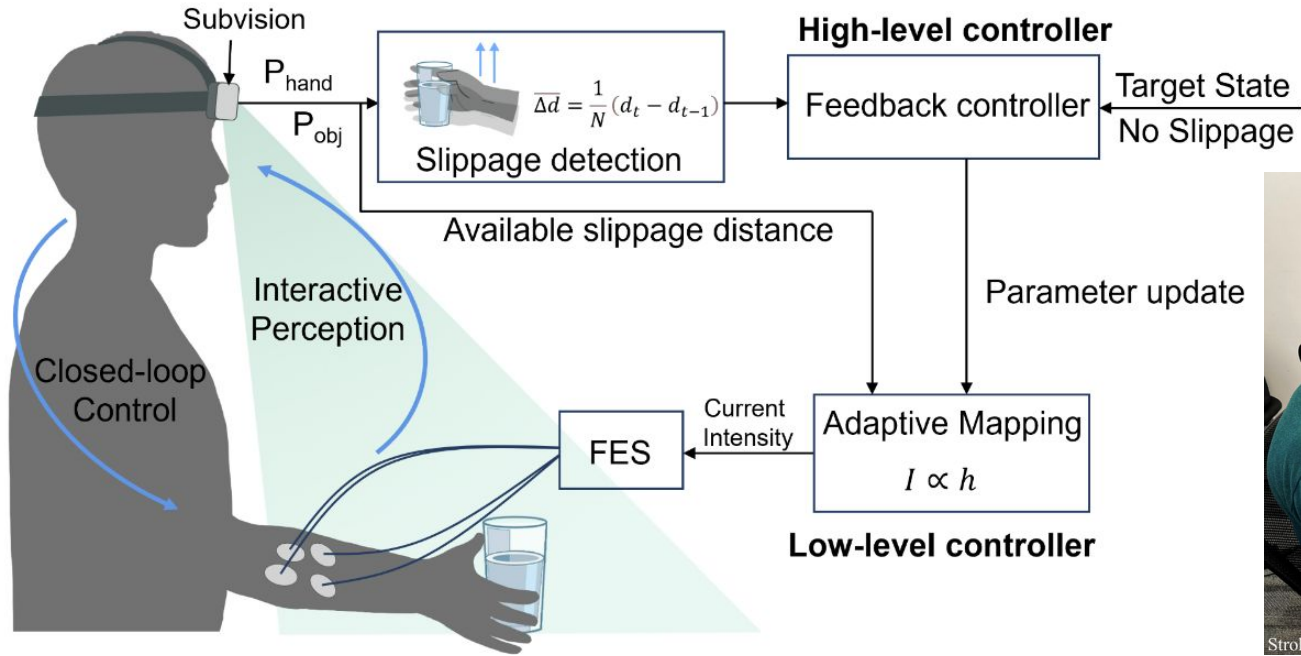
[3] F. Grimm et al., 2016

# Related Work



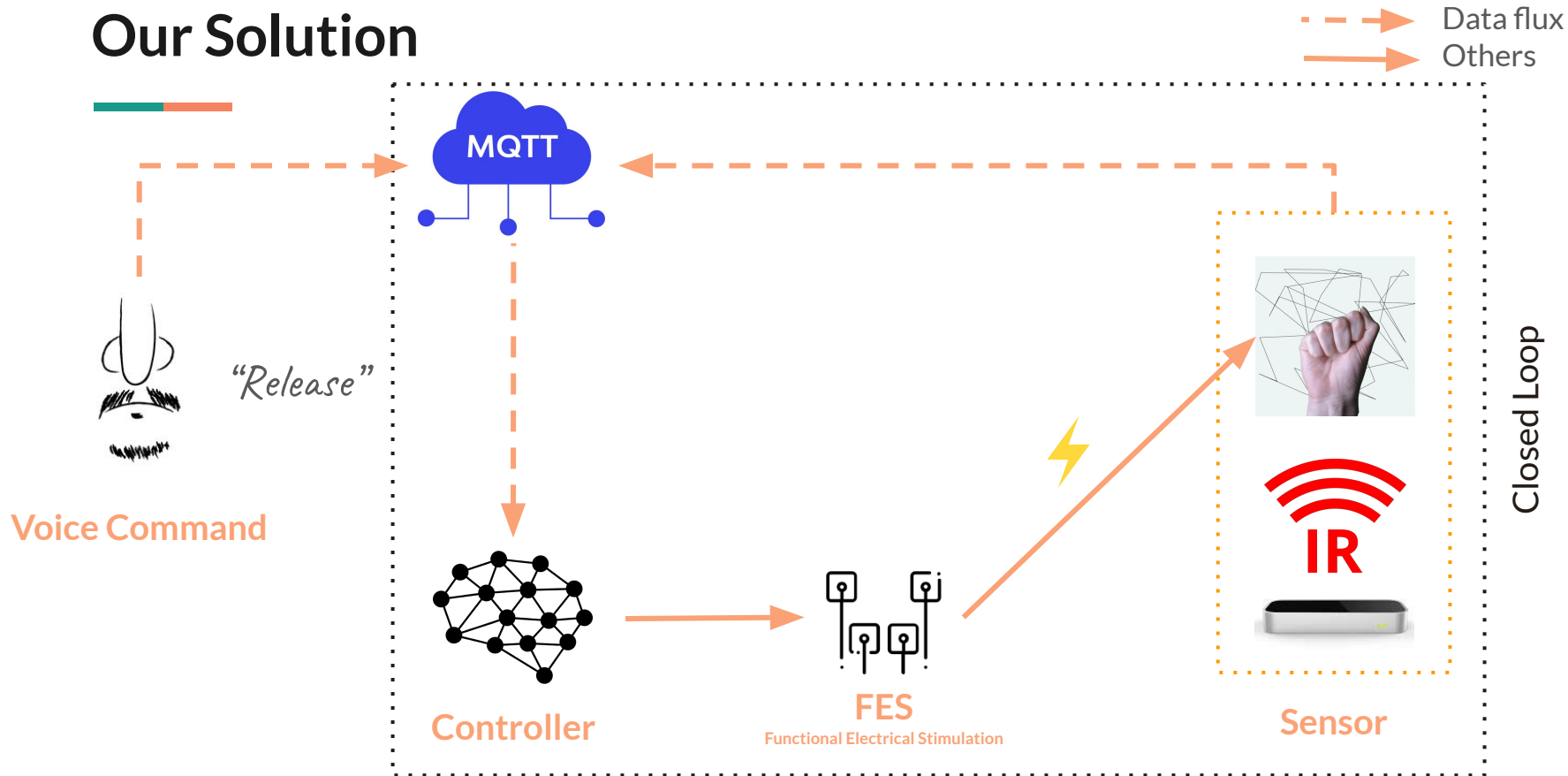


# Related Work



C. Lin., 2025 in IEEE Transactions on Medical Robotics and Bionics

# Our Solution





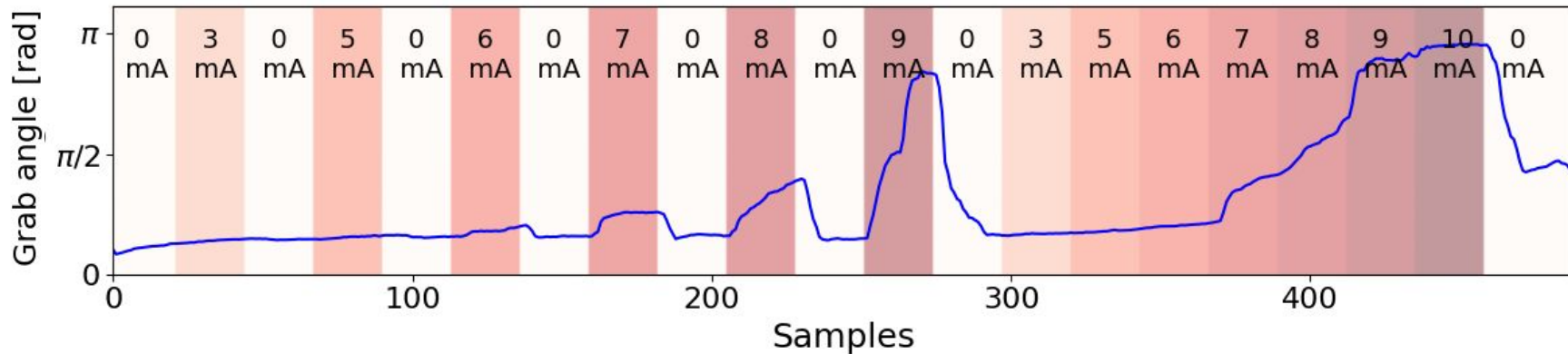
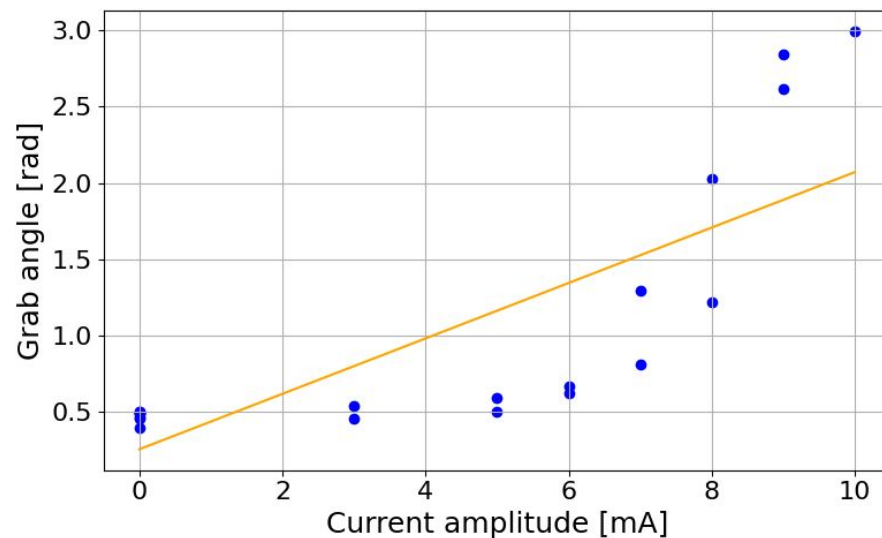
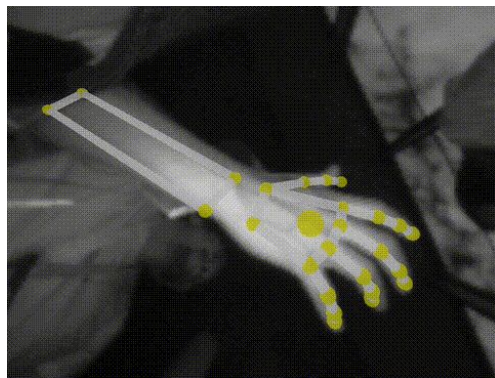
[🔧 Installation](#) | [📖 Used references](#) | [🖼️ Cool GIFs](#) | [👤 Authors](#)

[⚡ uv](#) [python version 3.11](#) [🌟 Star 3](#) [License MIT](#) [Contributions](#) [Welcome](#)

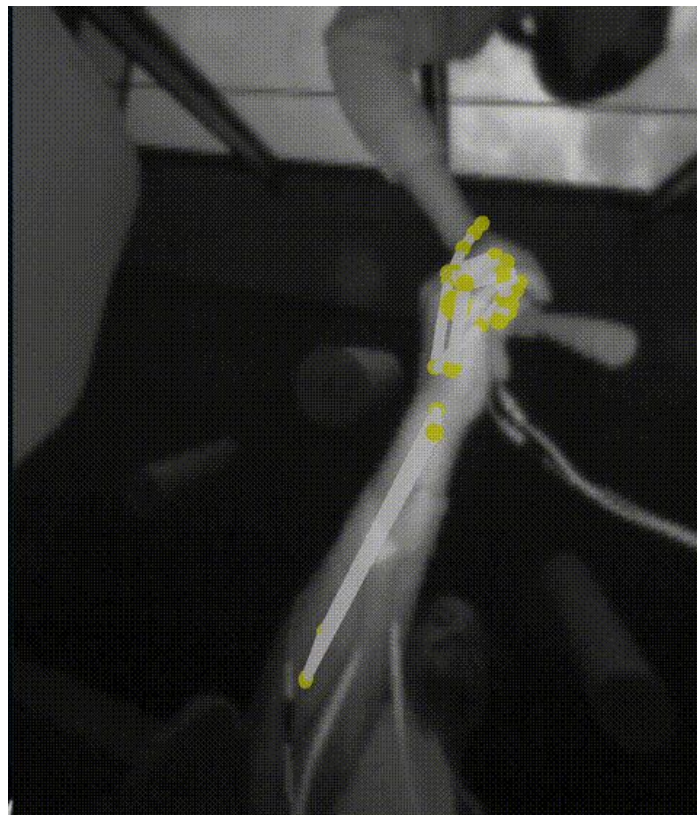
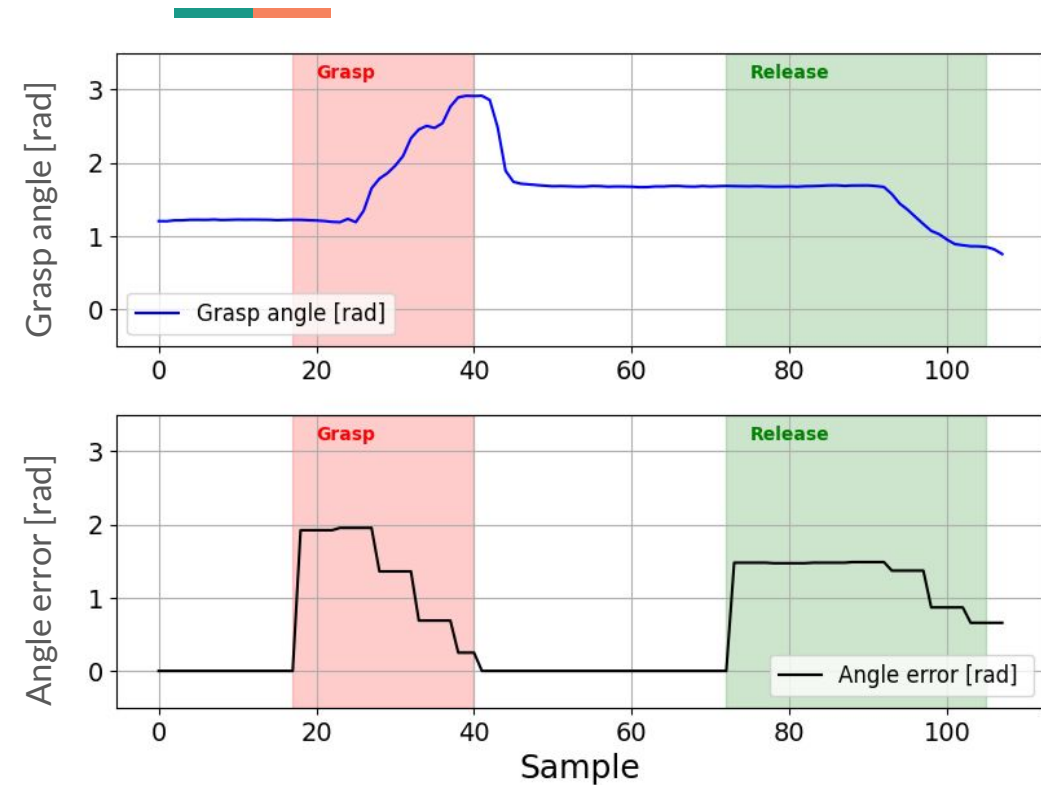
## Description of the project

Grasp It is a Python-based software system designed to induce hand movements—specifically grasping—through Functional Electrical Stimulation (FES), without requiring voluntary muscle activation from the user. By

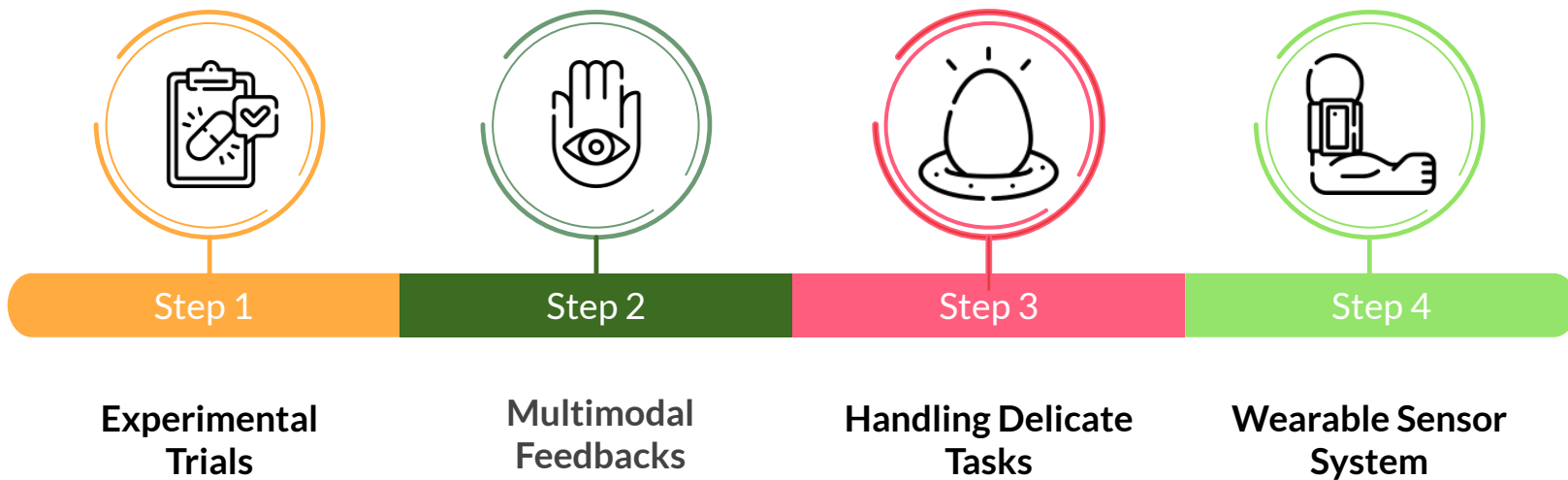
# Calibration: grasp



# Controller



# Roadmap



# Our Competitive Advantage



## Tailor-Made

- Adaptive feedback-based closed-loop system
- Works across different muscle types, skin conditions, and arm mobility levels



## Easy to use

- Non-invasive solution
- Modular and lightweight
- Voice command recognition — even works for users with speech impairments



## Affordable

- Designed to be cost-effective and accessible for individual users
- Also suitable for therapeutic centers and research institutions

# The Team



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Milo SANDERS  
Glodi DOMINGOS  
Johan BENJELLOUN  
Leandro SARAIVA MAIA  
Bianca ZILIOTTO

Project proposed by  
Federico CIOTTI  
(Left to right)



University  
of Exeter





# Mobile App Prototype

