An Instrumented Handle for Functional Assessment of Hand Performance in Stroke Rehabilitation

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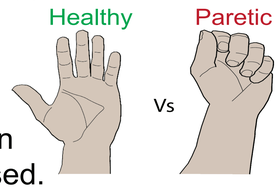
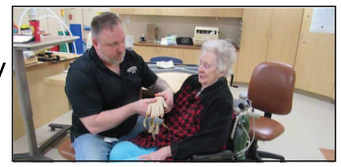
Hand Function Challenges in Stroke Patients

- Stroke often causes impairments in hand function, leading to difficulties with tasks in everyday life.
- **Task-specific hand functions** often remain limited and go under-assessed.

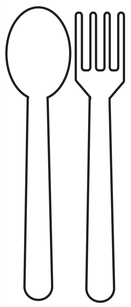


Current Rehab Tools Overlook Activities of Daily Living

- Tools like the ***Box-and-Block*** and ***Nine-Hole Peg Test*** measure speed and accuracy, not real-life task ability.
- Occupational Therapists **lack autonomous tools** to quantify hand function during actual daily tasks.



Design Constraints and Considerations



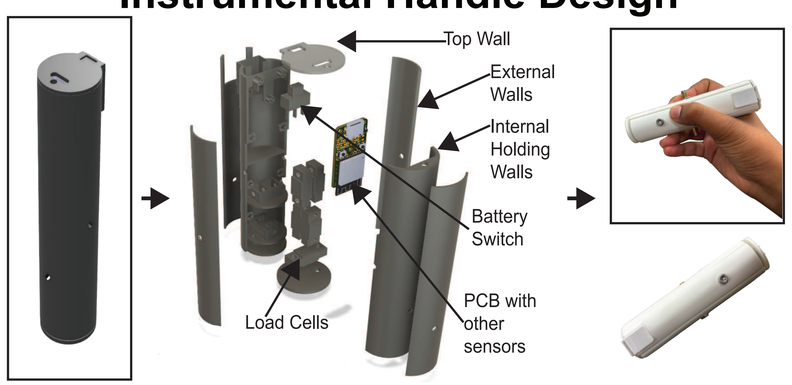
Form Factor: Mimic a standard Utensil or Tool

Modular Attachments: Be able to convert into different tools

Size and Weight: Compact and Light-weight hardware

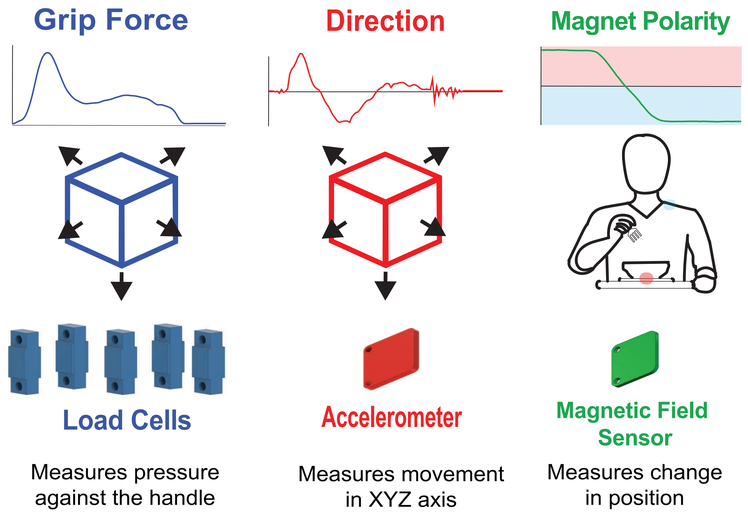
Measures: Determine progress in everyday tasks, like feeding and grooming

Instrumental Handle Design



Handle Data Collection

The Handle measures the following data points.

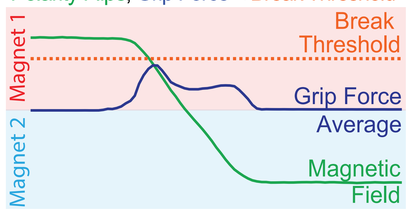


The Handle Automates Data Analysis

- The handle automatically classifies transfers based on the collected data.

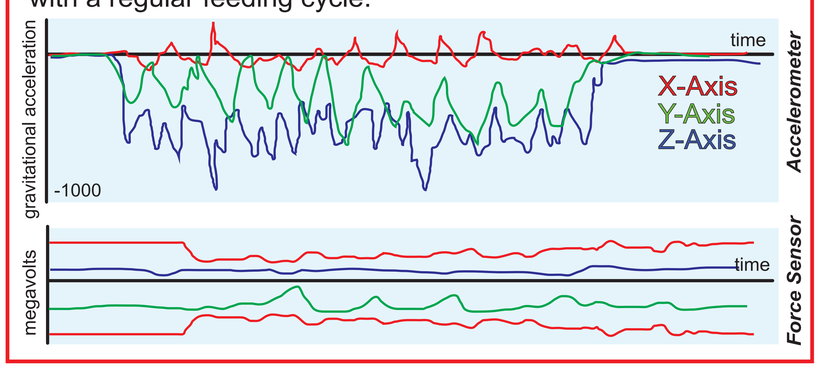
Different Types of Transfers

Successful =
Polarity Flips, Grip Force < Break Threshold



Example of Healthy Handle Use

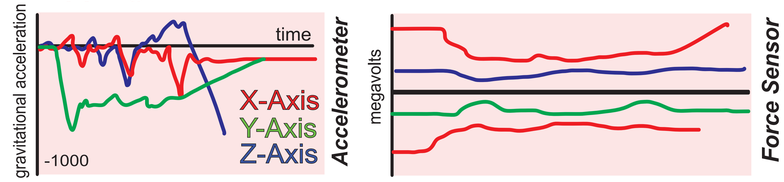
Data collected from using the handle as an eating utensil with a regular feeding cycle.



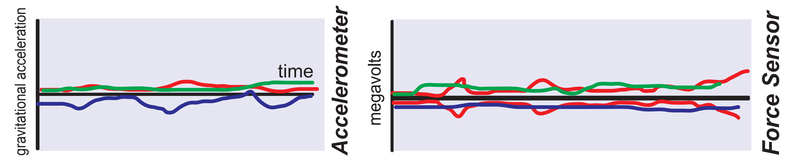
The Handle Quantifies Real-Use Deficits

These real-use examples illustrate how the handle captures fine motor challenges during everyday tasks.

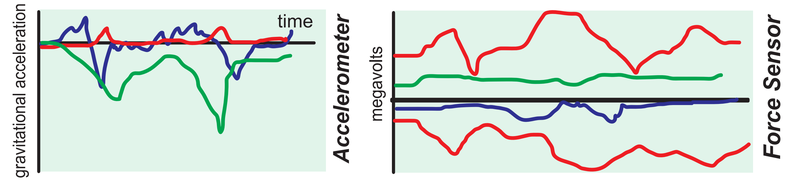
Dropping the handle



Difficulty Initiating Grip

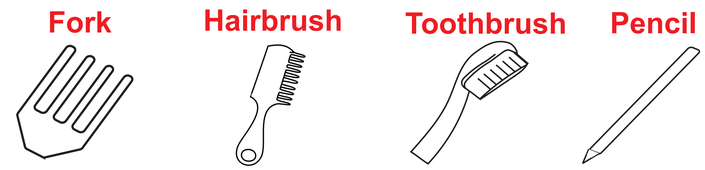


Unstable and Excessive Force



Potential Use Cases

Modular attachments can be created to adapt the instrumented handle to different activities of daily life.



Future Work

- Edit the design to use **2-axis force sensors** to reduce overall weight and increase accuracy.
- **Test** with stroke patients in real-world tasks.
- 3D Print and test the **modular attachments** for the handle

Acknowledgments

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