DESIGN AND DEPLOYMENT OF A SENSOR-BASED SYSTEM FOR ASSESSING POWERED MOBILITY USAGE IN YOUNG CHILDREN IN CLINICAL SETTINGS

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BACKGROUND & MOTIVATION

Powered mobility technology fosters exploration, social engagement, and cognitive growth for young children with disabilities [1].

Early access to these devices is critical, yet many children lack access during key developmental stages [2].

There is a need for tools and resources to support early intervention during critical stages of development.

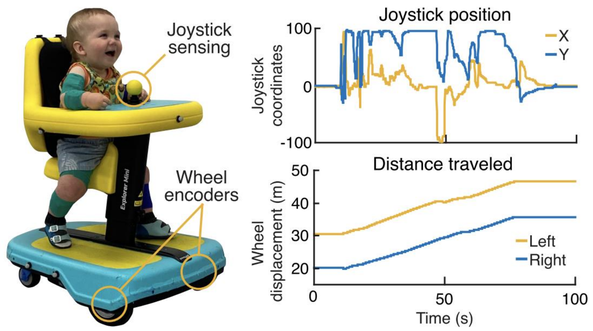
In this project, we…

- Design a clinician-facing interface to support in-clinic powered mobility assessments.
- Develop an algorithm that leverages quantitative data of child-device interactions to assess learning phase.

DEVICE & DATA COLLECTION

Instrumented Explorer Mini (EM)

The Permobil Explorer Mini is the only FDA-cleared powered mobility device in the U.S. designed for children aged 1-3 years.

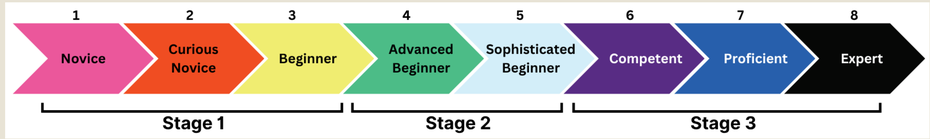


Our Dataset

- Nine children with motor disabilities with ages ranging from 12-36 months.
- Each child had 12 visits, each with two 15-minute sessions of child-led play with the Explorer Mini.
- Two raters assigned an **ALP Phase** for each visit.

We hypothesize that quantitative features of child-device interaction can predict distinct stages of cognitive and motor development.

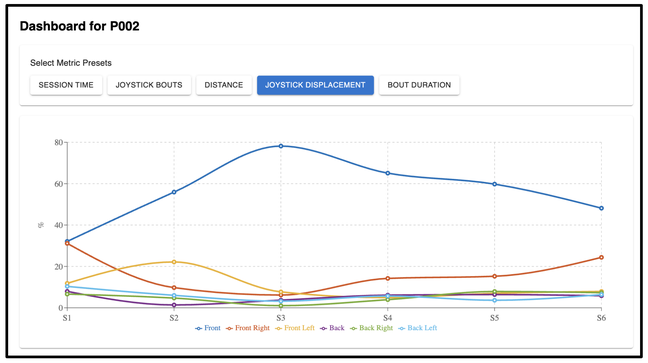
Definition: The Assessment of Learning Powered Mobility (ALP) Tool [3]

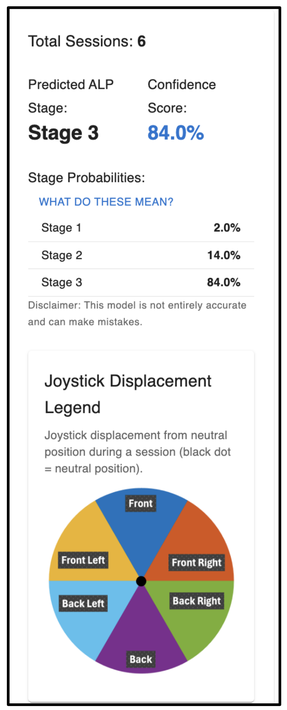


- Experts assign **ALP phases (1-8)** through structured observation of a child's attention, movement, emotion, and device comprehension.
- Each phase is structured with a corresponding treatment plan to guide intervention strategies.
- The **ALP Tool** is divided into three main stages: **Stage 1** – Exploring Function, **Stage 2** – Exploring Sequence, **Stage 3** – Exploring Performance.

AIM 1: DESIGN AN INTERFACE

A React frontend and Node.js backend are used with an Amazon S3 bucket for data storage and retrieval, with the interface accessed via iPad.





Selected Metric Presets

Through repeated feedback cycles with clinicians, key metrics were defined to visualize session progress overtime.

Session Time: Total session and active movement time.

Joystick Bouts: Count of bouts, activations, and attempts.

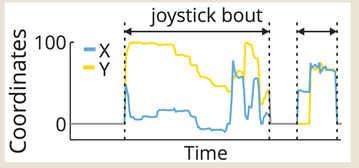
Distance: Total path length traveled by the Explorer Mini.

Joystick Displacement: Proportion of input across six directions:
Front, Front Left, Front Right,
Back, Back Left, Back Right.

Bout Duration: Average and max bout time.

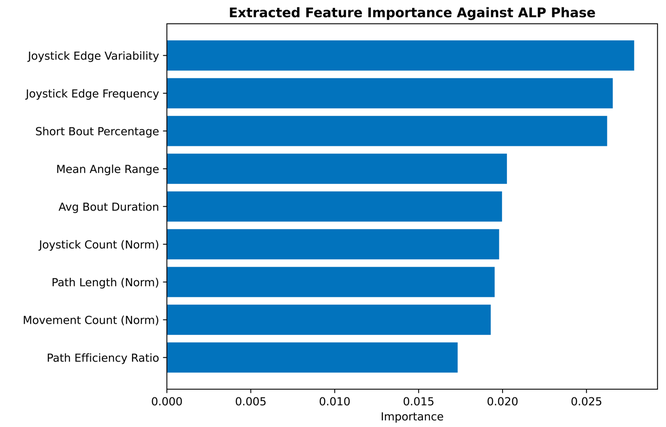
Definition: Joystick Bout

Joystick moved away from neutral (0,0) and back.

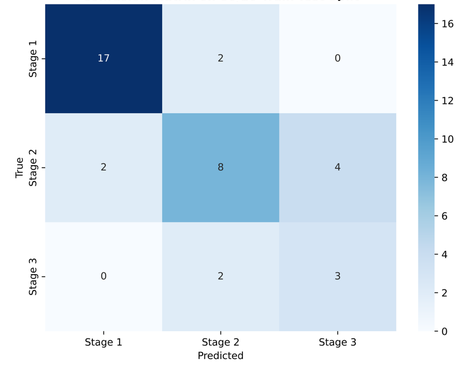


AIM 2: BUILD A PREDICTIVE MODEL

A Random Forest Classifier was trained using the top 10 extracted features from our dataset to predict ALP stage.



The model achieved **74%** accuracy on the test set and an average of **80%** accuracy across 5-fold cross-validation on the resampled training set.



NEXT STEPS

We will deploy the clinician interface at Kindering Developmental Center in Bothell, WA.

We plan to adapt the interface in response to clinician observations during sessions.

KINDERING
Embracing children of diverse abilities and their families

ACKNOWLEDGMENTS & REFERENCES

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