# Team SCOOT

## Improving the Accessibility of Micromobility: A Knee Scooter Case Study

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## Introduction

- Innovating micromobility technology with a novel kick-assist feature to enhance mobility and reduce the effort that need to be exerted for those with physical impairments.
- Aims to tackle the challenges of maneuvering rough terrain, inclines, comfort, stability, and durability in existing models, all of which are issues prevalent in current devices as revealed by stakeholder interviews.

**Research Goal:** Design a prototype knee scooter that is more ergonomic and utilizes novel kick assist technology to improve rideability for more users

## Value Proposition

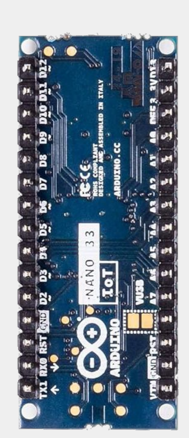
**How might we improve the common knee scooter to increase mobility during the rehabilitation process using powered assistance?**

## Electronic Components

350W, 36V, 8.5in. Motorized Wheel

36V, 10Ah Battery

ODrive Pro Motor Controller



Arduino Nano 33 IoT with Headers

SuperHandy 3 Mobility Scooter

KneeRover Original

## Data Collection

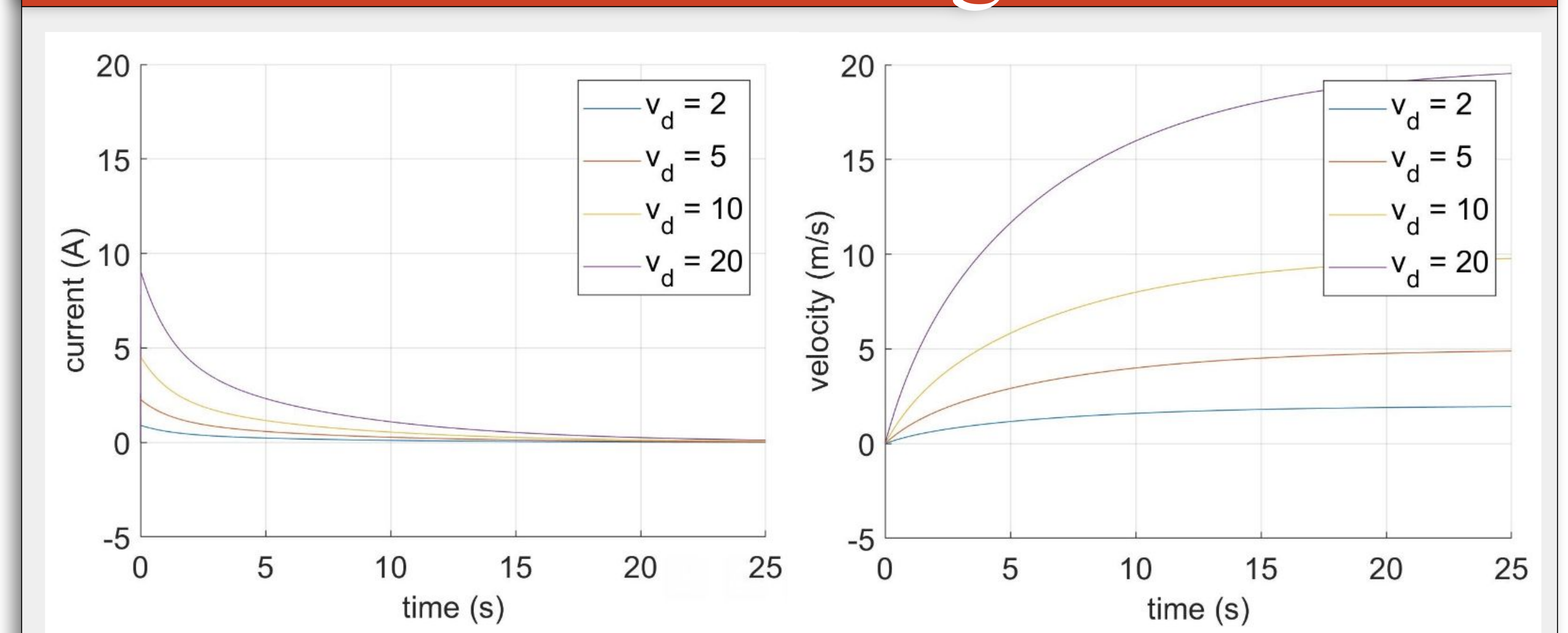
- **I-CORPS Customer Discovery:** process of interviewing potential customers and stakeholders to understand problems within the marketspace and research gaps.
- SCOOT conducted **92 interviews** consisting of individuals with limited mobility, disabilities, rehabilitation, and care center staff.
- Utilized feedback to refine SCOOT's value proposition.

## Analysis

Discovered the following:

- Traditional knee scooters have **uncomfortable** leg positioning, leading to **muscle strain** and **fatigue** during use.
- Current solutions have **poor stability and maneuverability**.
- Users experience **difficulties going up and down hills** and maneuvering terrain, particularly on campus settings.
- Wheels on existing models have **non-durable wheels** which are **not suitable for long-term** outside use.

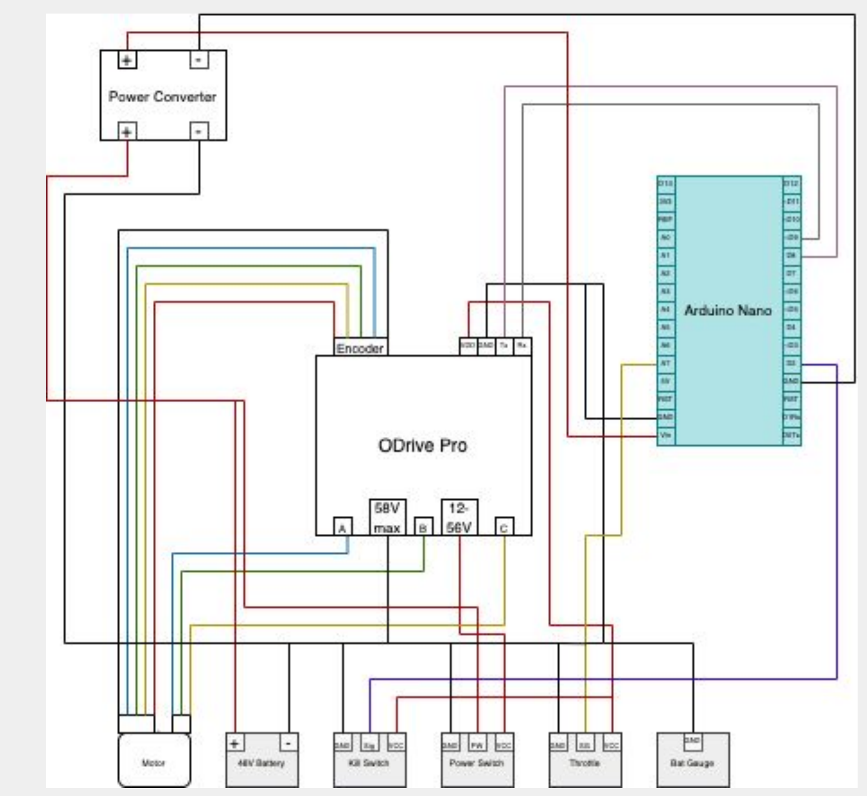
## Modeling




Plots of current and speed versus time for closed loop dynamics of general motor equations with ODrive velocity control loop for various desired velocity $v_d$

## Current Accomplishments

- Configured motor to be controlled by ODrive.
- With the ODrive, we can now control the SuperHandy's speed and torque having it respond to various external inputs.
- With the ODrive, we can also use the SuperHandy as a testbed to record how user kicks impact torque on the scooter's motor.
- We have replaced the rear wheel of the KneeRover with a motor, allowing us to test the code we are developing on a frame that is closest to what a knee scooter rider would operate.




## Future Research Goals

- Work on coding Arduino to communicate between the on board electronics, such as the throttle and brake, and the ODrive.
- Based on the response we record through the SuperHandy we plan to develop a program that reduces the amount of force that users need to apply to move in varying terrain.
- Migrate electronics onto traditional knee scooter as proof of concept device.

## Acknowledgements

Team SCOOT would like to give a special thanks to our mentor, **Dr. Derek A. Paley**, our team Librarian, **Pam McClanahan**, as well as the rest of the **Gemstone staff,** for supporting us throughout our research.

**References**