

Executive Summary

The Scottie Dock is a mobility assist device designed to help those, primarily the elderly, who suffer from limited mobility. According to the 2010 Census, there are 2 million elderly people who use a manual wheelchair daily [1]. Such patients are confined to a wheelchair but would enjoy more freedom without purchasing expensive equipment. The Scottie Dock is a cheaper mechanical and electrical system attachment for a motorized scooter to connect to the manual wheelchair, effectively converting the manual wheelchair into a power wheelchair. While seated in their own wheelchair, the patient is pushed up the ramps of the dock, which has guides to ensure the wheels of the wheelchair are aligned. Safety features are in place to firmly secure the wheelchair onto the dock. The motor is manipulated to give it reverse functionality and an emergency stop, thereby increasing its convenience. Thus, with the Scottie Dock, manual wheelchair users have the option of travelling independently, as opposed to relying on a caregiver to push them around. This device also frees up the nurse's time to help patients with more pressing needs. The patient can then easily move around using the device, and once they are done, the wheels are easily unlocked so the patient can undock safely.

Clinical Need

The Problem:

- Many people suffer from a lack of mobility as a result of insufficient muscle control or strength caused by old age, disability, injury, or disease.
- Manual wheelchairs are inexpensive and easy to transport but are difficult to maneuver because they require a large amount of upper body strength.
- Power wheelchairs are easier to maneuver but are prohibitively expensive, heavy, and difficult to transport.

The Need:

A way to increase mobility and independence for manual wheelchair users by providing a self-mobile system attachment to work alongside their current transportation mediums.

Market Analysis

- Approximately 9.2 million Americans aged 65 years and older have an ambulatory disability, including mobility impairment (U.S. Census Bureau 2009) [2]
- 3.6 million Americans use a wheelchair (U.S. Census Bureau 2010) [1]
- Of this wheelchair population, 2 million are aged 65 years and older (U.S. Census Bureau 2010) [1]

The Scottie Dock can benefit approximately 9.2 million mobility-impaired elderly citizens.

The 2 million elderly Americans who are current wheelchair users can also derive benefits from the Scottie Dock.

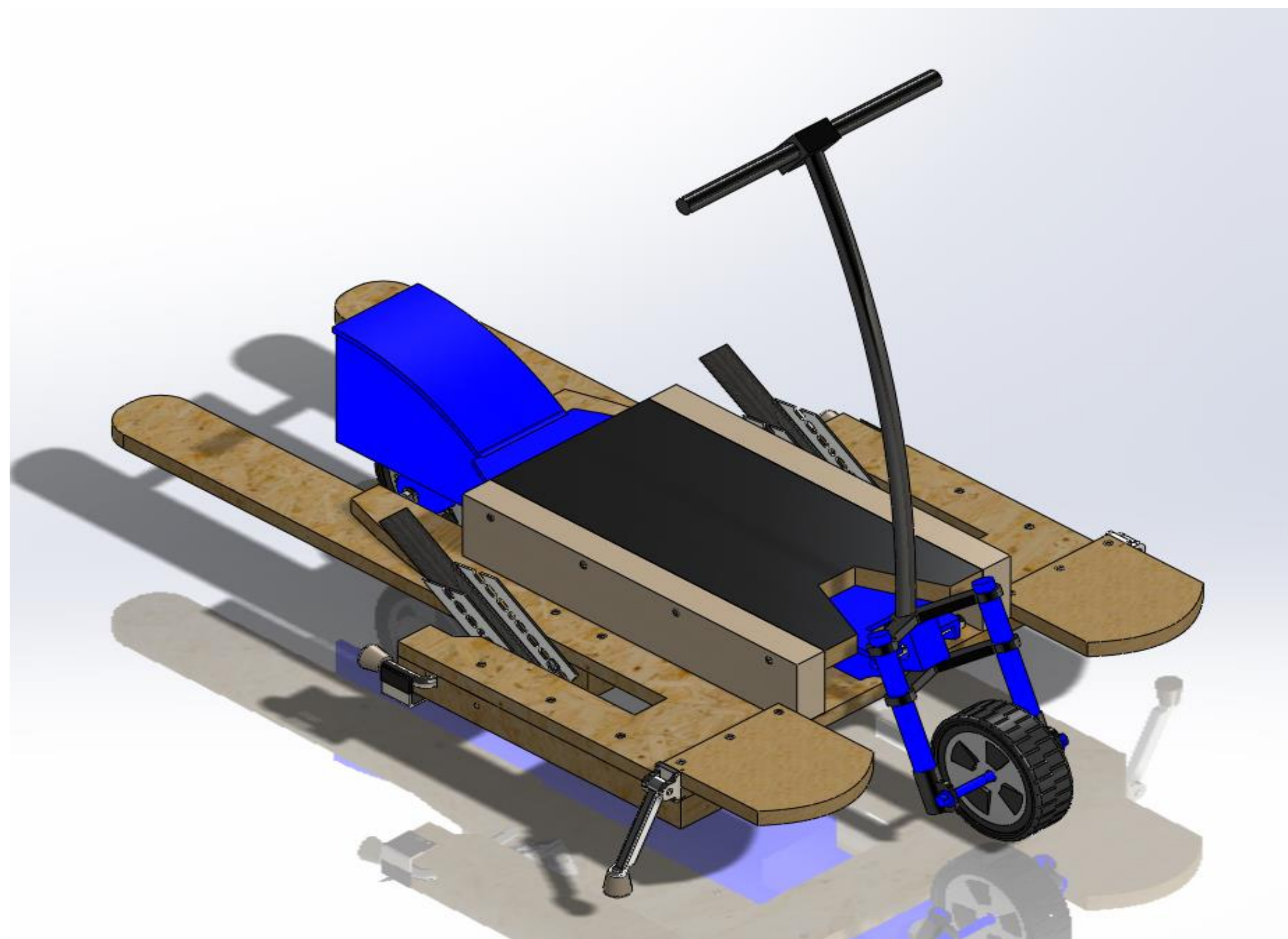
Novelty of Concept

- Increases mobility for those confined to a manual wheelchair
- Provides a manual wheelchair with the functionality of a power wheelchair at a fraction of the cost
- Once constructed and secured onto the scooter, the device is easy to implement as it requires no modification to current manual wheelchair
- Patients no longer have to rely on an assistant for transportation
- Can be used as a shared resource in public areas; if used in a nursing home, it gives nurses more time to attend to the needs of other patients

Description of Design

The Scottie Dock is an attachment designed to fit a patient's current manual wheelchair in order to increase and ease mobility for the elderly population.

Design: Wooden dock secured to a Razor E200/E225 scooter with a modified motor



Mechanical Features:

- Guide rails to align front wheels of wheelchair
- Door stoppers to maintain stability while docking
- Foot-operated wheel locking mechanism
- Holders for cane bolts so they do not interfere while using the dock
- Rubber tread along ramps to help grip wheels
- Cut-out for scooter charger
- Footrests for added comfort

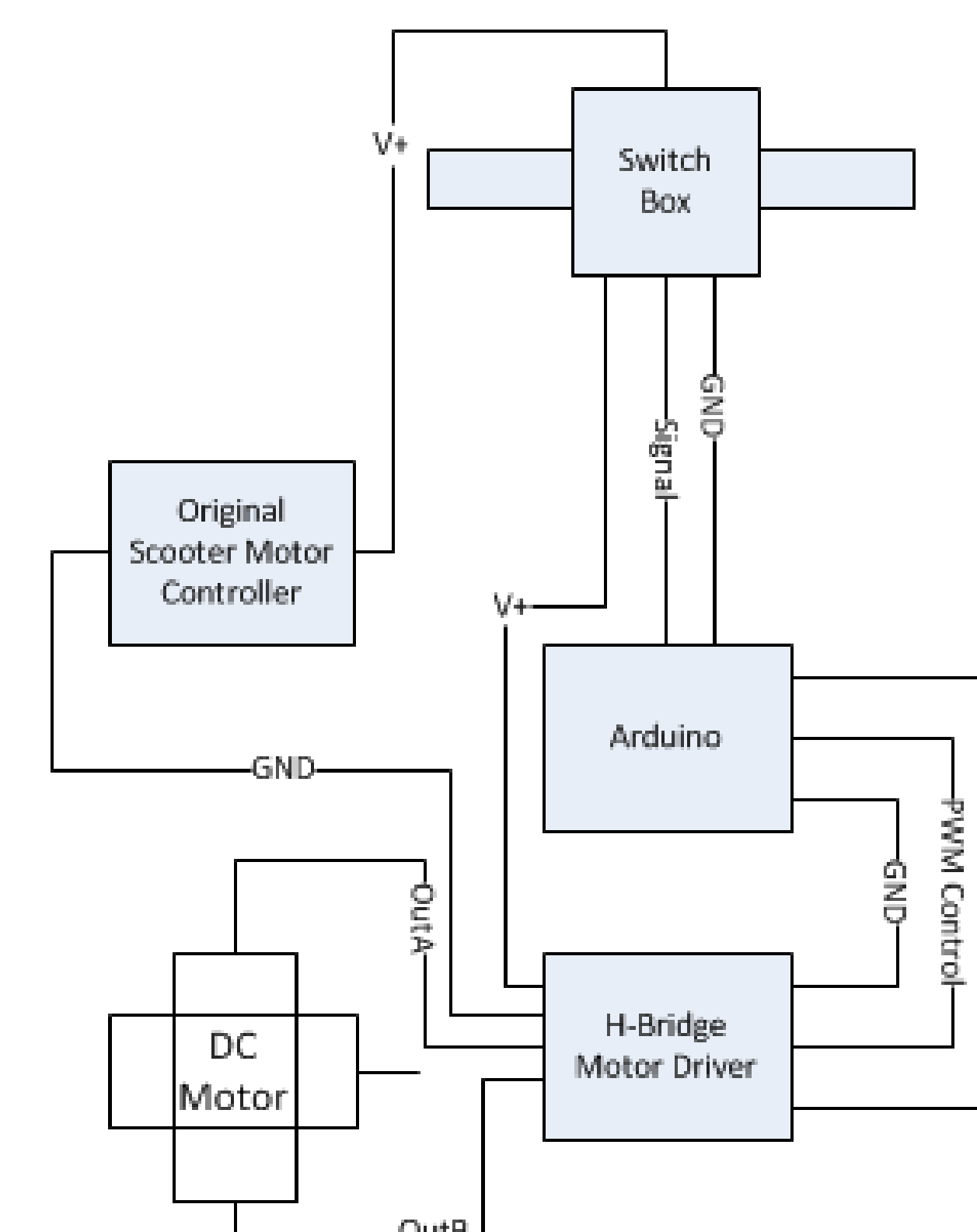
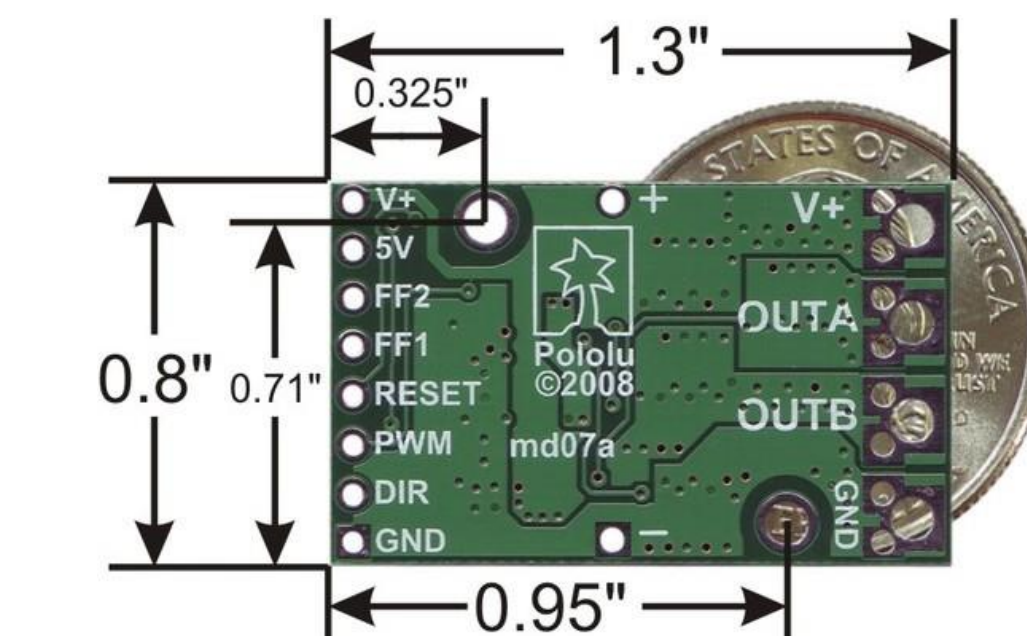
Electrical Features:

- User-centered control system on handle bar
- Bidirectional functionality for added reverse capabilities
- Emergency brake mechanism
- Easily editable code for pulse width modulation (PWM) control
- Compact set of components: Arduino board creates instructions, motor driver implements the action

Arduino Board [3]



H-Bridge Motor Driver [4]



Estimation of Product Costs

Component	Cost (USD)
Razor E200/E225 Scooter	200.00
Mechanical components <i>Wooden pieces to be machined from 3/4" plywood</i> - Top Plate, Right/Left Support, Base Plate, Bottom Support, Guide Rails, Footrests	75.00
<i>Purchased from Home Depot</i> - Screws, Nuts, U-Channel, Rubber Tip, Cane Bolt, Rubber Sheet, Set Screw Collar, Door Stopper	
Electrical Components - Arduino Microcontroller Rev 3, Pololu High-Powered Motor Driver, Switches	75.00
Total	350.00

Device Testing

- Observed by Larry Powell, Equal Opportunities Services Manager of CMU's Disability Resources, who was in favor of its compact size, small turning radius, ease of locking
- Device can climb handicap accessible ramps, clear doorways, traverse various terrain
- Future Work: rearview mirrors, reflectors, adjustable footrests, basket for belongings

Anticipated Regulatory Pathway

- Mechanical wheelchair alone constitutes a Class I device [5]
- Power wheelchair and scooters are Class II devices [5]
- The Scottie Dock combination wheelchair/scooter is substantially equivalent to an electric mobility scooter, so we expect it to be classified as a Class II device
- Requires approval through 510(k) process, exempt from Premarket Approval

Acknowledgements

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