MPOWRD 2.0
The Next Step in Wheeled Mobility

Background
Stroke can affect the muscular and motor function of patients asymmetrically. Traditional self-propelled wheelchairs require the use of both arms with equal strength, and are either impossible or painful for stroke patients to use.

Electric and lever powered wheelchairs exist, but are expensive and often unavailable for patients in lower-resource countries.

MPOWRD 1.0 designed a lever powered wheelchair that could be used by stroke patients, but there were areas of needed improvement.

Goal and Objectives
MPOWRD 2.0 improves on MPOWRD by making it more patient-friendly, based on feedback from the first year. Focuses for improvement include:

- Redesign armrest to be usable by patients of differing heights without shoulder hiking (which can set back physical therapy)
- Faster Braking with less hand strength
- Wheelchair can be controlled with only one hand

Innovation
The Yoke Clutch allows one-handed control of both wheels using a linear bearing system. Thus patients with asymmetric strength can control the chair.

An adjustable arm rest will allow patients of a range of heights to use the wheelchair without hiking their shoulder. 30 people were polled on ring road to find a range of seat-elbow heights, which had an average of 24.5 cm

Swapping stock bike brake pads for trick pads made of 'grippier' materials gives patients better control for starts, stops, and turns

Requirements and Current Status of Subsystems

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Marginal Description</th>
<th>Ideal Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm Rest</td>
<td>Attached to lever to fit height of average user (24.5 cm from seat)</td>
<td>Arm rest is adjustable to specific patient's needs</td>
<td>Data of arm height recorded, CAD altered and 3D printing commenced.</td>
</tr>
<tr>
<td>Braking</td>
<td>Brake can slow chair from 1 m/s to stopped within 1 m</td>
<td>Brake can slow chair from 1 m/s to stopped within 0.5 m</td>
<td>Brake pad chosen, ready for installation</td>
</tr>
<tr>
<td>Yoke Clutch</td>
<td>Pulling the bike brake on one side will engage clutch on both wheels</td>
<td>Yoke clutching can be engaged or disengaged by the patient</td>
<td>Parts arrived Week 8, assembly in progress</td>
</tr>
</tbody>
</table>

The Bigger Impact of MPOWRD 2.0
The independence of mobility has a massive impact on the quality of life for patients. Electric wheelchairs are often unattainable for patients in lower resource countries.

Creating MPOWRD as a kit to modify existing Free Wheelchair Mission chairs will make it available for patients who would benefit from it the most. MPOWRD 2.0 makes MPOWRD capable of daily use.

Timeline
- Fall - Goals List, Concepts, Research Needs
- Winter - Subsystem finalization, parts list, first prototype complete
- Spring - Human testing, prototype refinement, Wheelchair complete

Budget:
$600 + parts donated by FWM

Team Members
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With all parts in, the next step will be testing the wheelchair’s performance and fine tuning it to best meet patient needs.

The Yoke Clutch system is the largest innovation from MPOWRD, and will require debugging and testing to make its use as smooth as the original two-handed control system.

Durability testing will be needed for all subsystems, as replacement parts will not be readily available in the locations MPOWRD 2.0 is targeting. These kits will need to be easy to install, endure a variety of environments, and above all else be intuitive for patients to use on a daily basis.

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