Wheelchair Exercise Tracking Device

An affordable, easy to use, social, and motivating solution

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Difficulties faced by wheelchair users in exercising

Affordability

- **There is a lack of affordable exercise equipment for wheelchair users**
- **E.g.: Wheelchair treadmills or rollers can cost above 1000$. [1]**
- **E.g.: Arm ergometers range from 90$ till 225$. [2]**

Infrastructure

- **Many of these options are specialized and only available in a limited number of gym facilities, requiring a gym membership and potentially driving a long distance from home. [3]**

Motivation

- **The existing equipment is either boring or challenging to use, according to users. [4]**
- **E.g.: Arm ergometers are perceived as boring, and it is difficult to to reach a high heart rate using them. [4]**

Our vision

Our vison is to design a device for wheelchair users with loss or impairment of lower body function, to track their daily activity and motivate them to be active that provides quantifiable feedback regarding their activity levels.

Project goals

- **Must accurately track data**
  - Measured parameters: rotations, distance in m/km
  - Metric: 10% error margin
- **Must be adjustable**
  - Measured parameters: cm
  - Metric: minimum 7 cm of adjustability
- **Must not impede wheelchair movement**
  - Measured parameters: Change in speed and angle
- **Critical value:** Maximum margin of ±0.2 km/h difference in speed, and ±3° deviation in angle after the device is installed

Our Engineering analysis reveals that.....

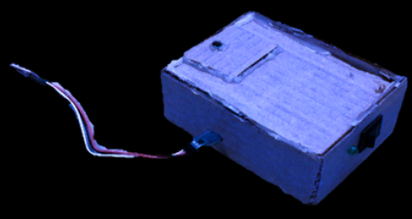
- The device exerts less than one Newton of external forces on the wheelchair.
- As this was under our critical value of 1 Newton, there were no revisions needed, and the device does not impede wheelchair movement.

Unique Features

- **Social aspect - sharing data with other users**
- **Motivation - Tracking personal data and comparing it with other users.**

Our solution

Design concept



Low-fidelity prototype

The prototype accurately measured details like wheel rotations and time elapsed in our tests. The average error was 0%

What next?

- **A higher fidelity prototype.**
- **A working application.**
- **Testing sociability, ease of installation, and motivtion provided**
- **Potential for user testing.**

[1]. “Wheelchair Treadmill & Rollers | Living Spinal.” https://livingspinal.com/wheelchair-rollers-and-treadmills/ (accessed Nov. 29, 2022).

[2]. “Arm and Leg Ergometers | OrthoCanada.” https://www.orthocanada.com/en/arm-leg-ergometers (accessed Nov. 02, 2022).

[3]. K. A. Martin Ginis, S. Jörgensen, and J. Stapleton, “Exercise and sport for persons with spinal cord injury,” PM R, vol. 4, no. 11, pp. 894–900, Nov. 2012, doi: 10.1016/J.PMRJ.2012.08.006.

[4]. R. N. Wong et al., “Exploring exercise participation and the usability of the adaptive rower and arm crank ergometer through wheelchair users’ perspectives,” Disabil Rehabil, vol. 44, no. 15, pp. 3915–3924, 2022, doi: 10.1080/09638288.2021.1894245.