

# A novel portable and cost-efficient wheelchair training roller: The EasyRoller

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## Background

Assistive technology devices (ATDs) are globally prescribed by physicians, as part of their care for patients [1]. Accordingly, there is a great demand for ATDs; it is estimated by the 2010 World Health Report on Disability that more than one billion people globally need ATDs, the majority of which are people with disabilities. However, only 10% who needs these also has access [2]. One example of such ATDs are stationary training rollers. These devices enable wheelchair users to maintain physical health, which serves to treat and prevent immobility-associated chronic disease and improve cardiorespiratory fitness [3]. Unfortunately, conventional exercise equipment is largely inaccessible for persons with disabilities, due to various barriers such as affordability, durability, adaptability, and maintenance and repair costs [4]. Expense remains one of the major barriers to these devices, which is at its steepest in economically disadvantaged settings [5]. This discrepancy in access to physical activity has further been emphasized during the recent COVID-19 pandemic [6], reinforcing the need for the development of accessible exercise equipment for people with disabilities.

## Aim

To develop and prototype a portable, cost-efficient stationary training device for wheelchair users in low-resource settings.

## Methods

Stakeholder input from wheelchair athletes, trainers, and potential commercial manufacturers was solicited and utilized to conceptualize The EasyRoller. The device was constructed from easily sourced and off-the-shelf, low-cost components, such as aluminium, conveyor belt rollers, and Olympic weights. Next, it was user-tested with Para athletes. Feedback was analysed and incorporated into renewed prototype versions.

## Results

The EasyRoller creatively combines easily-sourced components to significantly cut down cost and ease both manufacture and repair for use in low-resource settings. The device has the following characteristics:

- ❖ Total weight: 34 pounds.
- ❖ Total size: 42 linear inches.
- ❖ Total cost: USD\$199.

Feedback emphasized the user-friendliness of the device and its potential to benefit coaches, athletes, and any wheelchair user interested in maintaining health.

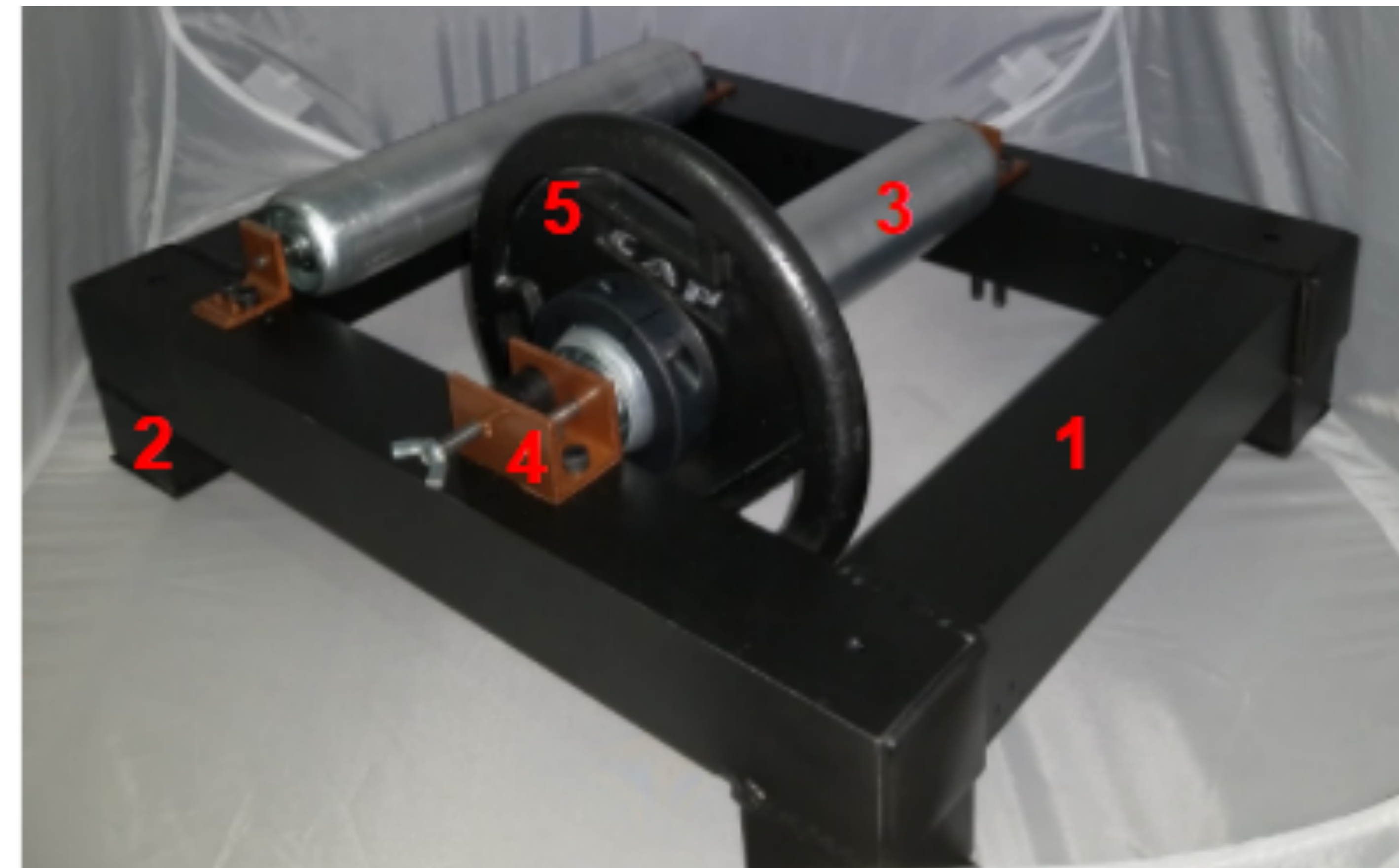


Figure 1. First generation prototype of The EasyRoller. Shown here is one of the two free-standing roller frames with (1) the aluminum frame with (2) raised feet, (3) conveyor rollers, (4) friction disc brake, and (5) inertial weight (5 lb. Olympic weight shown).

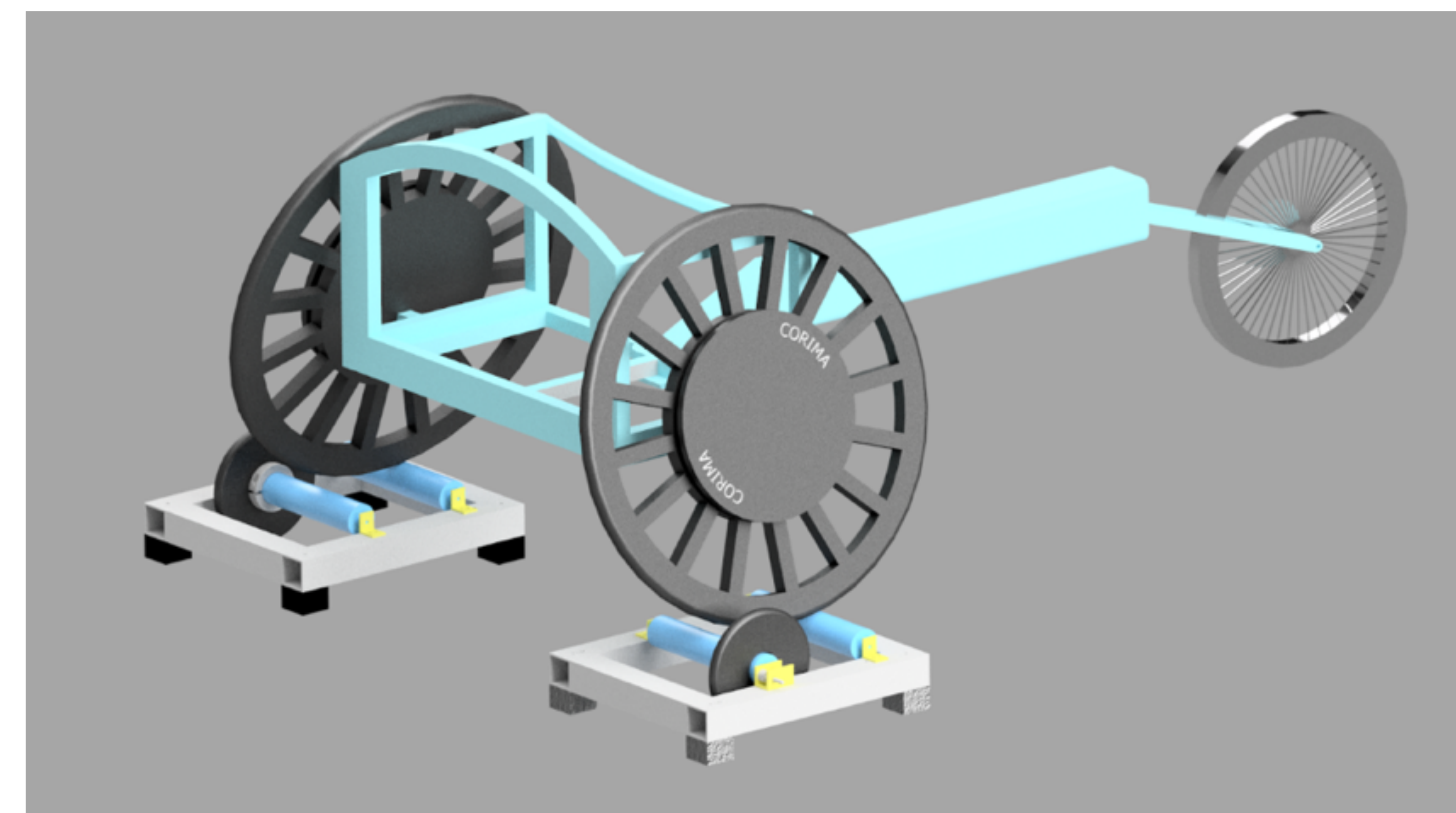


Figure 2. Computer Aided Design (CAD) rendering of The EasyRoller set up with a racing wheelchair. Note that the front wheel stabilizer (wedge recommended) is not shown in this image.

## Discussion

Despite ongoing global efforts, a gap remains between the need and provision of ATDs such as stationary training rollers for wheelchair users, particularly for those in socioeconomically deprived world regions [7]. The EasyRoller has the potential to contribute to closing this gap by abating various barriers that create the inaccessibility of such devices. To address the issue of affordability, The EasyRoller creatively combines commonly sourced and off-the-shelf components, to significantly cut down cost of materials and production. Portability concerns are resolved by minimizing weight and dimensions such that they meet the standard checked luggage requirements for most commercial airlines – namely a maximum allowance of 22.7 kg (50 lbs) and 157 linear cm (62”). The design is safe meeting the ASTM standards user weight (113 kg, 250 lbs) and vertical height (<170mm) requirements. Ease of production and maintenance was achieved by using components that are easily sourced and can be assembled by anyone with basic welding expertise, creating potential opportunity for bulk manufacturing and assembly in various global settings. End-user testing proved the design could simulate an effective track workout, proving an important point as the users of ATDs are experts about their own needs [8].

The development of The EasyRoller is in line with several global initiatives that highlight the importance of development of accessible ATDs, such as the Global Cooperation on Assistive Health Technology (GATE) initiative from the World Health Organization and the Sustainable Development Goals (SDG) of the United Nations. Developing accessible ATDs contributes greatly to expanding participation in desired life activities for people with disabilities and therefore generates an inclusive society [7].

## Conclusion

There is a gap in accessibility to appropriate ATDs such as exercise equipment for wheelchair users, particularly in poor settings. The EasyRoller is one solution to this dearth of opportunity, offering a low-cost, portable, easily maintained, environment-appropriate exercise equipment for wheelchair users around the world – including those living in socioeconomically deprived world regions.

## References

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