VARDAAN: A Convertible Manual Stair Climbing Wheelchair

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The manual stair climbing wheelchair is designed for people with lower limb disability to enhance their personal mobility. One of the basic problems faced by users of manual wheelchairs is overcoming architectural barriers like kerbs and stairs on their way. Varadaan facilitates climbing up and down the stairs by using a “Y” shaped wheel that provides better grip and optimum braking along with a ratchet and a braking system. The “Y” shaped wheel is designed by mimicking the human gait while climbing up. For climbing up the user pulls and pushes the lever ratchet attached on the axle of the Y shaped wheel. The design makes use of the fact that people with lower limb disability have high upper body strength and therefore pulling/pushing the ratchet lever can be conveniently operated by them. While climbing down the user can use brakes to control the motion of the wheelchair as the “Y” shaped wheel rolls down the steps. The braking system along with the “Y” shaped wheel is likely to make the wheelchair a safe solution for climbing stairs for users. This same wheelchair can be converted instantly to move on level ground too.

The initial prototype has been tested under various conditions like step sizes of stairs, people with different weights (58 kg-89kg) and it has shown satisfactory results. The wheelchair can navigate stairs with 230-350 mm width and step heights from 110-185 mm. VARDAAN can climb almost every public stair that conforms to the National Building Code Specifications (India) for public buildings.

It is important that the physically challenged people are included in the mainstream and this design serves this need. Wheelchair is one of the most commonly used assistive devices for enhancing personal mobility and assists people with disabilities to become more productive members of their communities. But extant wheelchairs have limitations against architectural barriers. In most of the schools and institutes in India the lack of accessibility for wheelchair bound students restricts their basic education.

Designing wheelchair for stairs climbing can be a solution for autonomy in mobility for wheelchair users. By negotiating stairs with a stairs climbing wheelchair, a huge no. of buildings in India would be accessible to wheelchair users just like any other user. This will open doors for many opportunities like better education, job, and better quality of life.

Varadaan is an economic, safe, user friendly and efficient stair climbing manual wheelchair. It is a simple machine designed for climbing stairs with mechanical benefit via lever ratchets system and braking system. A “Y” shaped wheel is designed for better grip and optimum braking for climbing up and down.

Currently the stairs climbing devices are electrically/battery operated and are expensive for both Indian markets as well as for international markets. Ibot (powered stair-climbing wheelchair) is the example technology marvel but it is too expensive ($29,000) for an ordinary user to buy. A stairs climbing manual wheelchair is an economic solution (<10% of the cost of Ibot) for a user to negotiate the stairs. But only few manual stairs climbing devices exist in the world and unfortunately there is hardly any product existing in the Indian market.

There is a genuine need of such product in the market as per the THE PERSONS WITH DISABILITIES (EQUAL OPPORTUNITIES, PROTECTION OF RIGHTS AND FULL PARTICIPATION) ACT, 1995, also called the PWD Act, 1995, it is mandatory to have an accessible environment in every public building for physically challenged users and this is one way to make it possible in the existing environment. It can inspire many others to bring changes against ignorance in the society. It is a novel project that can bring remarkable improvement in the quality of life of many physically challenged people in the world.

Varadaan is focused on permanent active wheelchair user with good upper body strength i.e.
• People with spine injury
• Army persons with war injuries
• Accidental cases

So far the product design is focused on independent stairs climbing manual wheelchair but in future the same concept can be developed for many other users with diverse needs of such wheelchair like,
• Stairs climbing powered wheelchair,
• Assistant operated manual wheelchair.
• Assistant operated battery operated wheelchair.
• External device attachment for stairs climbing,
• Paediatric stairs climbing manual and powered wheelchair.
• Different range of products can be designed with the use of various materials.
• Stairs climbing wheelchair for specific usage for example in airports, railway stations, hospitals etc.

People with disabilities face many problems because of several barriers in day to day life but development in assistive technology ensures adaptation against barriers in the existing environment and enables equality in society. This product directly aims at inclusion of the physically challenged people in the mainstream of the society.

The product is very close to commercialization. The product is developed and tested in the lab and has shown satisfactorily results. Once this product is developed using right materials and few design modifications to make it more user friendly, it will further require testing under various conditions and by many users. It can be developed for masses after few design iterations as a result of testing. The product can be automated with necessary add-on as per future demands of the product in the market.
There is a tremendous scope of design in this field. Stairs climbing wheelchair is just a first step towards it. This product can be commercialized in Indian as well as international market for different target user economic layers.