International Journal of Analytical, Experimental and Finite Element Analysis (IJAEFEA), Issue. 1, Vol. 3, March 2016.
e-ISSN: 2394-5141, p-ISSN: 2394-5133, pp 4-6

Design and Fabrication of Handicapped Bicycle: A Review

Vinod M Gaikwad[1]
vinodmech26@gmail.com,
Dada B. Chavan[2]
dadachavan2260@gmail.com
Kumar C. Ghogare[3]
ghogarekumar@gmail.com
Suraj D. Bhagwat[4]
Bhagwatsuraj143@gmail.com
Prof. M. P. Wasnik[5]
monishwasnik@yahoo.com

Department of Mechanical
S. B. Patil College of
Engineering, Indapur, Pune,
Maharashtra, India

Abstract **- A wheelchair is a device used for mobility by people for whom walking is difficult or impossible, due to illness or disability. It typically consists of a seat supported on two large wheels on an axle attached towards the back of the seat and two small wheels near the feet, though there are often small additional features to prevent toppling or to assist mounting curbs. The person moves by pushing with his/her hands circular bars on the outside of the large wheels with a diameter that is slightly less than that of the wheels. The activity was started with customer survey and market study. The questionnaire was framed keeping the needs of physically challenged people in mind. The major inputs received from this study were related to ingress\egress issues, ergonomics, carrying wheel chair and utility space. Traditional manual wheelchair having chain mechanism which required more efforts to drive the tricycle and control of both arms for operation. To avoid this problem this projects was carried out. In this project we use single slider mechanism instead of chain mechanism. Our goal is to provide comfort and less effort for operation of tricycle. Mobility vehicles are designed based on the usage, i.e. either indoor or outdoor. The cost of vehicle may not be affordable for a disabled people. So the focus is laid on the simplicity in design, high performance, easy maintenance & safety at very reasonable price. This paper provides detail of component used & designing parameters takes in consideration while designing the tricycle. This tricycle is very efficiently designed and can be proved as a better replacement for the tricycle having chain mechanism and we provide a clutch for engagement and disengagement of shaft whenever required . Keeping in mind the factors such as safety, cost & performance this tricycle is design.**

Index terms: **-** Mobility, single-slider mechanism, clutch, wheelchair

I. INTRODUCTION

Disability could be caused by birth, by injuries sustained mainly from motor accidents or during turnkey project work or in manufacturing industries as well those caused naturally. Due to the enormous number of disabled people in the society, a wheelchair tricycle has been fabricated and designed to specification. In response to demand of wheelchair user for equal access, hand-propelled wheelchair, electrically controlled wheelchair, and automated guided wheelchair have been developed. However, because upper body strength is required, a hand propelled wheelchair does not permit an older or severely disable person on extensive range of travel [5]. A clutch is provided for the engagement and disengagement of the shaft for the continues power whenever it is required.In privious paper continues motion of the strearing mechanism is difficult to restrict and it will create problem for the driver. To overcome this problem a clutch is placed between the shaft of rear wheel.A hand tricycle works in the same way as a bicycle as it uses a chain system with pedals to drive the wheels, Except in the case of hand tricycle, the chain is attached to hand pedals instead of that we use single slider mechanism which allow the user much more efficient propulsion than would be provided by the hand pedal wheelchair. The wheelchair is simple in construction, the tricycle wheelchair is easy to operate and the maintenance of wheelchair is very less [1].

The project's goal is to provide a good living condition for people considered to be physically challenged (disabled), to transport themselves around their environment. The various factors considered in designing wheel chair.

A. Rolling resistance

Rolling resistance is the first thing to overcome to make a wheelchair roll easy. It depends on the surface the wheelchair is driving on, mass distribution on the wheels, wheel radius, total mass and specific tire characteristics.

The most important external aspect in al of this is the surface on which the wheelchair is moving. Indoors it's possible to make the floors hard and smooth. Outdoors there is not much one can do to decrease resistance as a result of the characteristics of the surface.

B. Slopes and obstacles

Other important elements are slopes and obstacles. Indoors on can make adjustments like using slopes and taking away obstacles. Outside this is a bit more difficult. Then one can only adjust the wheelchair itself, like making the wheelbase longer, so it will be easier to climb curbs.

Aspects in the wheelchair itself influencing the manoeuvrability and rolling resistance are weight, handrim, camber angle, the seat, back support and castors.

The weight of wheelchair and user together influence the amount of rolling resistance the user had to overcome. Mass distribution is also an important aspect. Most of the total weight should lie over the rear wheels, yet not as much as causing the wheelchair to tip backwards.

An optimal configuration of the wheels is an important factor in overcoming rolling resistance. A larger distance between rear wheels and castors decreases the pressure on the castors, resulting in a lower rolling resistance. It is also

important to prevent toeing in and out of the rear-wheels. Another factor is the type of tires around the wheels [3].

C. Internal friction

Special attention should be given to internal friction of the wheelchair caused by, for example, loose bolts and nuts, sliding joints and non-elastic connections.

The handrim is an essential part of a wheelchair for it is used to propel, brake, steer, negotiate obstacles and manoeuvre. Important aspects in finding the optimal power transmission from hand to handrim are shape, size, diameter, material and profile of the handrim, and antropometry, squeezing force of the hand, (dis)abilities and special wishes of the user. It should be noted that propelling a wheelchair using handrims is physiologically the least efficient way of propelling a wheelchair.

A large diameter of the handrim results in a relative high mechanical efficiency and effective force. In case of propelling a wheelchair over a long distance it is energetically favourable to use a handrim with a smaller diameter.

The way of grabbing the handrim when propelling influences the mechanical efficiency greatly. Also the friction coefficient is of great influence. It should be as low as possible in order not to brake the wheels while propelling, but it should be high enough to make it possible to transmit a certain amount of power from hand to handrim.

A camber angle has a positive influence on the stability sideways, the power transmission from hand to handrim and the manoeuvrability.

When using a camber angle, there is more risk for toe-in or toe-out, more pressure on the rear wheal axle and the complete wheelchair becomes wider. In general is the camber angle for an ADL-wheelchair 2 to 4 degrees and for a racing wheelchair between 4 and 12 degrees [4].

D. Position of the user

The most important aspects of the seat of a wheelchair are the horizontal and vertical position of the user, because they greatly influence the energy needed to propel the wheelchair. In general it is best to position the centre of mass right above the rear-wheel axle (horizontal position). In the vertical direction the user should be positioned in a way that he can just touch the rear wheel axle with his fingertips.

The position of the seat influences the accessibility of the handrim, and therefore the efficiency of power transmission from hand to handrim and the mechanical efficiency [4].

E. Castors

Castors are sensitive to forces exerted sideways. It can cause them to shimmy. When castors are positioned in a vertical position it is the easiest to make turns.

Each user has his own characteristics influencing the efficiency of propelling a wheelchair and his own idea of comfort. These characteristics are age, gender, figure, physical health and (dis)abilities. In general it can be said that wheelchair users don't have much muscle mass in their arms and shoulder girdle, which makes it extra hard to propel a wheelchair. Still, a wheelchair should not keep a user from being mobile and of his social life.

II. CLUTCH

A *Clutch is* a machine member used to connect the driving shaft to a driven shaft, so that the driven shaft may be started or stopped at will, without stopping the driving shaft. A clutch thus provides an interruptible connection between two rotating shafts

Clutches allow a high inertia load to be stated with a small power.

A popularly known application of clutch is in automotive vehicles where it is used to connect the engine and the gear box. Here the clutch enables to crank and start the engine disengaging the transmission Disengage the transmission and change the gear to alter the torque on the wheels. Clutches are also used extensively in production machinery of all types [2].

To design analyze the performance of these devices, a knowledge on the following are required.

1. The torque transmitted
2. The actuating force.
3. The energy loss
4. The temperature rise

A. Problem Definitions

(1) Some designs of tricycle are complex and expensive.
(2) Performance is low for traditional manual wheelchair.
(3)They require larger usages of human energy and it increase tiredness.
(4)As per the review there are countless injuries & conditions, Including stroke, paralysis, muscular dystrophy that require Individual to depend on a wheel chair as their main means of mobility.

B. Objective

The main objective is to design and manufacturing a cost effective wheelchair tricycle for easier accessibility and increased performance to the wheelchair user which reduces the efforts of handicapped people.

C. Specific Objective

(1) To increase the speed of vehicle by mechanism and engage & disengage the shaft whenever it is necessary for continue power.
(2) To reduce the efforts of paddling for the disabled people.
(3) To increase the efficiency of handicapped wheelchair with the traditional manual operating wheelchair.
(4) More effective on uneven load.
(5) More economical for poor people.

III. WORKING PRINCIPLE

The tricycle wheelchair is work on the single slider mechanism which is operated by steering. On comparison with old traditional hand pedal wheelchair which have of chain mechanism, instead that we use single slider

mechanism. The following fig shows overall view of tricycle. Figure1 shows a complete mechanical system in which the single slider mechanism is the main component. On that single slider mechanism a steering is mounted for operating the tricycle, which define the direction to tricycle and used to take turning to the left or right.

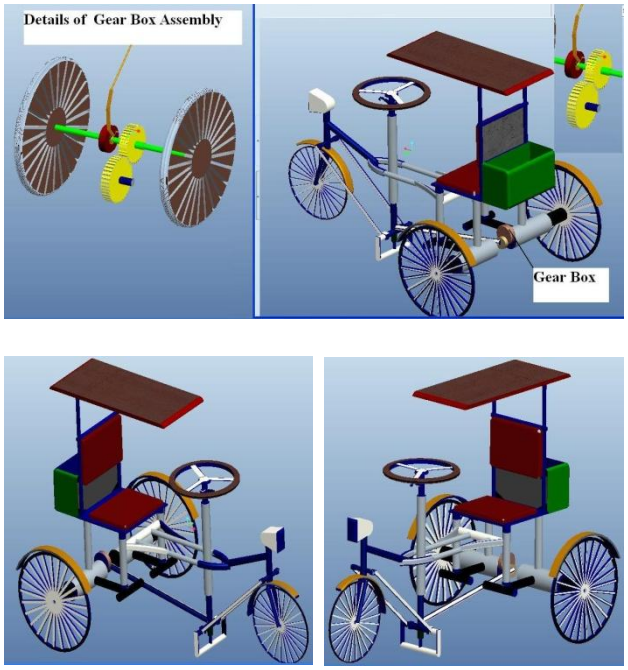

Fig 1: Design view of handicapped tricycle

From the above figure, A clutch is provided for the engagement and disengagement of the shaft for the continues power whenever it is required.In privious paper continues motion of the strearing mechanism is difficult to restrict and it will create problem for the driver.To overcome this problem a clutch is placed between the shaft of rear wheel.

IV. Conclusion

In our project we utilized single slider mechanisms and clutch is provide for the engagement and disengagement of shaft whenever it is required for operating tricycle hence it is most useful and economical as compared to the other tricycle.

Reference

[1] Giuseppe Quaglia, Walter Franco and Riccardo Oderio, “Wheelchair, Motorized Wheelchair with Stair Climbing Ability”, Mechanism and Machine Theory, Vol. 46, No. 11, pp.1601-1609, 2011.
[2] Murray J Lawn and TakakazuIshimatsu, “Modeling of a Stair-Climbing Wheelchair Mechanism with High Single Step Capability”, Vol. 11, No. 3,pp. 323-332, 2003.
[3] Wang H, Salatin B, Grindle G G, Ding Dand Cooper R A, “Real-Time Model Based Electrical Powered Wheelchair Control”, Medical Engineering & Amp. Physics, Vol. 31, No. 10, pp. 1244-1254.2006
[4] Disability status report: Rehabilitation Research and Training Center on Disability Demographics and Statistics, United state, 2006.
[5] Brown, Sheldon, The Geometry of Cantilever Brakes. Harris Cyclery Home page. 2008. Retrieved 17 Nov. 2008.