Design & Fabrication of Wheel Chair for Handicapped People

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Abstract - 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. A large verity of mobility vehicles are available in market, form which one is to be selected as per requirements. 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. Keeping in mind the factors such as safety, cost & performance this tricycle is design.

Index terms: - Mobility, single slider mechanism, wheel chair.

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. The design of a wheelchair tricycle is an improvement on the existing ones. It is carried out to benefit the user conveniently, physically, and comfortably such that when a little effort is exerted, a greater output (movement) is achieved as a result of the fast transmission generated by the single slider mechanism. 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.

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.

A. Problem Definitions
(1)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.
(2) Some designs of tricycle are complex and expensive.

(3) Performance is low for traditional manual wheelchair.
(4)They require larger usages of human energy and it increase tiredness.

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 reduce the efforts of paddling.
(2) To increase the efficiency of handicapped wheelchair with the traditional manual operating wheelchair.
(3) More effective on uneven load.
(4) More economical for poor people.

II. 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.
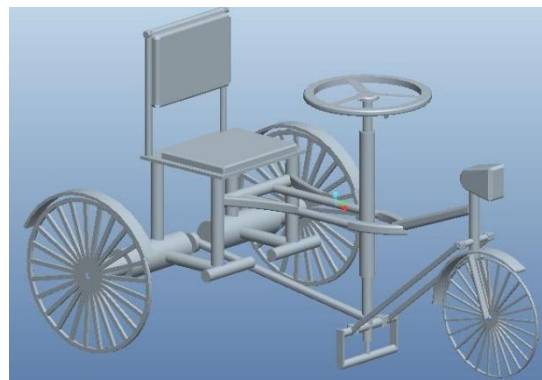

Figure 1: Overall view of tricycle

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.

A. Working Of Single Slider Mechanism

When we have to go in forward in direction then just move steering from backward to forward with little effort which move the tricycle in forward direction and when we have o go in reverse direction then we have to first stable the tricycle and then move steering from forward to backward in direction which move tricycle in reverse direction. The steering is provided for giving direction and for too & flow motion which move tricycle in forward & reverse direction.

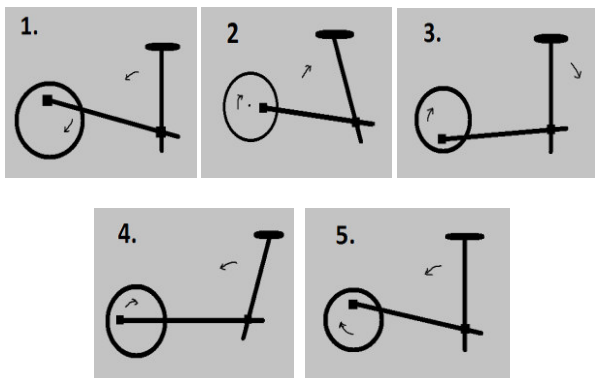Working of single slider mechanism for forward direction is given as follows:-

Figure 2: Different Position of Single Slider Mechanism

III. MATHEMATICAL CALCULATION

A. Calculation with total weight
Wt. of tricycle=35 Kg
Wt. of disable people = 60 Kg (maximum condition)
Diameter of wheel = 60cm = 0.6m
N=100 rpm (maximum condition)

$$w = \frac{2\pi \times N}{60}$$
$$= \frac{2 \times \pi \times 100}{60}$$
$$= 10.47 \text{ rad/sec}$$

$$\text{Velocity} = w \times r$$
$$= 10.47 \times 0.3$$
$$= 3.141 \text{ m/sec}$$

$$\text{Total force} = \text{total weight}$$
$$= 95 \text{ Kg}$$
$$= 95 \times 9.81$$
$$= 931.95 \text{ N}$$
On each wheel
$$F1 = F2 = 465.97 \text{ N}$$

$$\text{Torque} = F1 \times r$$
$$= 465.97 \times 0.3$$
$$= 139.79 \text{ Nm}$$
So effort required
$$T = \text{effort} \times \text{dist. of link}$$
$$\text{Effort} = \frac{139.79 \times 10^3}{1200}$$
$$= 116.49 \text{N}$$
$$= 11.87 \text{ Kg}$$

For half revaluation
Effort = 5.93 Kg

$$\text{Power} = \frac{2\pi NT}{60}$$
$$= \frac{2\pi \times 100 \times 139.79}{60}$$
$$= 1.463 \text{ KW}$$
Speed
V = 3.14 m/sec
V = 11.3 Km/hr

B. Calculation for diameter of shaft
Formula for diameter
$$T = \frac{\pi \times Fs \times d^3}{16}$$
Where,
T = torque
Fs = Sus = ultimate shear strength
d = diameter of shaft
Material for shaft
Carbon steel (mild steel)
SAE 1010 (Hot rolled)
Ultimate tensile strength = Sut = 379 MPa

We have relation,
Sus/Sut = 0.75
So we get,
Sus = Fs = 284.25 Nmm2
Therefore,
Diameter of shaft
$$139.79 \times 10^3 = \frac{\pi \times 284.25 \times d3}{16}$$
d=13.58mm
Std. diameter =15mm

IV. RESULT ANALYSIS

Wt. of tricycle with steering mechanism=35 kg
Wt. of tricycle with chain mechanism=45 kg
Wt. of disable people=60 kg

TABLE1. BY CONSIDERING TOTAL WEIGHT (WT. OF TRICYCLE + WT. OF DISABLE PEOPLE)

Particulars	Tricycle with steering mechanism	Tricycle with chain mechanism
Weight	95 kg	105 kg
Force	465.97 N	515 N
Torque	139.79 Nm	154.5 Nm
Power	1.387 KW	1.132 KW
Speed	11.3 Km/hr	7.88 Km/hr

TABLE2. BY CONSIDERING ONLY WEIGHT OF TRICYCLE

Particulars	Tricycle with steering mechanism	Tricycle with chain mechanism
Weight	35 Kg	45 Kg
Force	171.67 N	220.77 N
Torque	51.5 Nm	66.2 Nm
Power	0.657 KW	0.623 KW
Speed	13.78 Km/hr	10.238 Km/hr

V. CONCLUSION

In our project we utilized single slider mechanisms for operating tricycle hence it is most useful and economical as compared to the other tricycle. This tricycle is made of material which is available easily in market. This tricycle is mostly useful for elder and handicapped people. It is simple in design and easy to operate. The efforts made for operating tricycle is less this is an advantages of this tricycle. The tricycle cost is less as compare to other tricycle.

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