Foot Operated Steering For Handicap People

[1]Ashish Patil, [2]Chetan Regade, [3]Darshan Sabale, [4]Shashank Dandage, [5]Prof. S.B. Lande

Department of Mechanical Engineering Universal College of Engineering & Research, Pune.

Abstract: - *Travelling has turned into a basic piece of individuals' regular day to day existence. At specific circumstances, in expansive nations like India, individuals are compelled to travel more than 200 km from their work place to their place of living arrangement. Individuals with handicaps in lower furthest points and hands experience issues in voyaging and can't travel these long separations. They utilize gadgets, for example, wheel seat, braces and fake appendages for versatility. These however can't be utilized for long separation open air transportation. In this manner, the point of this review is to outline and manufacture 'Foot worked framework' for armless individuals. The framework will be utilizing "Rack And Pinion" plan, which changes over turning movement into straight movement. The framework comprises of wheels, inward strung chamber, lead screw, linkages, turning pinion and rack. This framework is conservative and in this manner will be utilized for long separation transportation. The principle goal of the venture is to plan a foot worked framework for impaired individuals and will be helpful in daily reason. This framework will be practical and simple to work.*

Keywords: *Handicap People, Armless, Foot Operated System, Lead screw arrangement with rack and pinion, bearing for wheel rotation.*

1. INTRODUCTION

Presently a day's transportation has turned out to be awesome trouble to and individual to achieve the goal on time. Everybody has their own vehicle and individuals with all body parts are lucky. In any case, it is appalling for in part incapacitate individuals with hands. Handicap is the repercussion of a weakness which can be mental, physical, passionate, vision, tactile. Incapacities can happen in furthest points and in addition in lower limits. Accordingly these individuals turn out to be more wards and lose their certainty. Because of this impact, they stand an incredible drawback in utilizing open and in addition private transportation offices.

Today numerous associations on the planet are keen on the improvement of vehicles which could empower incapacitated individuals to appreciate a higher personal satisfaction, and perhaps work. There are many individuals in this world sort of physical incapacity. The issues that a hard of hearing, visually impaired or incapacitated individual experiences at work are, now and again, inconceivable troubles. Tragically the generation of open offices for handicapped individuals in the working environment is regularly either exceptionally troublesome or extremely costly. Due to late mechanical advances, the incapacitated could involve many positions and could have their expert limit rethought. Any commitment made by electronic frameworks to empower the independence of the crippled at any stage ought to be thought of not as an extravagance, but rather as a need. The vehicle portrayed in this paper is coordinated at addressing the requirements of those movement-debilitated people who can't drive vehicle physically nor with a guiding however they are having solid legs.

There are not very many creation vehicles made for individuals with incapacities. Much of the time, standard creation vehicles are uniquely changed to provide food for drivers and travellers with inabilities. Changes can run from basic increases of a directing wheel spinner handle to real adjustments to the vehicle body structure, for example, amplifying the body length and modifying the top of the vehicle.

2. LITERATURE REVIEW

2.1. A Low Cost Mobility Solution for Physically Challenged People; "Pranchal Srivastava, Raj Kumar Pal"

The most common approach used in most powered wheelchairs is having two motors for traction each driving a wheel on either side of the machine. Forward motion is achieved by keeping the speeds of the motors identical in one direction and the other direction for reverse motion. Turns are executed by making the speeds of the motors different. The radius of turn depends on the speed difference. This system depicts three novel approaches for cost effectiveness and efficient working, firstly having a powered wheel chair drive with a gear mechanism which is used to generate proper speed of the wheels on the either side with single power motor. The advantage of this system is that it makes the system control easy and cheap. Secondly, utilization of waste brake energy for battery charging which lead to reduced cost of powered wheel in the long run.

2.2. Dual Steered Three Wheeler For Differently Able People; "Arun Raju C , Anish Raman C , Veerappan K.R. Venkat Narayanan

The aim of this study is to design and fabricate a 3 wheeler with dual steering system for people with locomotive disabilities .A greater steering effort is required in the case of a four wheeler compared to a three wheeler. Hence, a

three wheeler was selected instead of a four wheeler. In this case, handle bar steering system and leg steering system can be individually steered with hands and legs respectively, enabling its utility people with disabilities in upper extremities. Sprocket chain system was used in leg steering system. A 98cc Kinetic Honda Engine was used as the power source and the engine was placed towards the rear end of the vehicle. Single Rated and double rated suspension spring was used in the front and rear drive shaft respectively. Sprocket chain system was used in leg steering system.

2.3. An Efficient Car Driving Controller System Design for Physically Challenged People Using Arm Processor; "Katari Ramaiah, T. Mallikarjun" The aim of the technology is to help those handicapped who don't have healthy hands to run a vehicle by giving the voice commands. In this the driver need not use the steering instead his head. This vehicle is only for those handicapped those who can nod head well. Four switches are interfaced over the neck of the driver, and the vehicle can be controlled by the head movement. Corresponding tactile switches are activated according to the movement of the head, and towards the conclusion the practical difficulties are described and the possible solutions are discussed.

3. METHODOLOGY

The framework comprises of an inside strung pinion and one remotely strung lead screw which are locked in like nut and fastener course of action. C-clip is utilized to exchange the movement of lead screw. A rack is associated with C-clasp. The rack is locked in to first pinion. This pinion is midway lined up with second pinion. One more rack is associated with this pinion to change over turning movement into direct movement. The wheels are at both closures of the rack.

At first the pinion is turned in clockwise course by utilizing left foot. Because of this movement, the lead screw moves to one side. C-clasp exchanges the movement to the rack. Rack moves alongside C-clasp. The principal pinion which is locked in with rack will begin pivoting in clockwise course because of movement of rack. The second pinion likewise pivots in same heading as the first. The second pinion again exchanges movement to another rack which has wheels at its both the closures and rack will move in right bearing. Because of the movement of rack, the wheels will move to right bearing and vehicle will take right turn. Also, when driver pivots pinion in hostile to clockwise course the correct inverse system will happen and vehicle will take left turn. This framework can be mounted in autos having programmed equip framework in light of the fact that the grasp of the vehicle is to be supplanted by lead screw and pinion match.

4. PROBLEM STATEMENT

We need to build up a framework that is named as the foot worked controlling framework. Foot Steer is a stunning advancement in vehicle control for individuals with extremely constrained abdominal area quality and great lower appendage control. To suit the prerequisites of crippled drivers with these uncommon conditions, this high innovation arrangement takes into account the vehicle to be controlled utilizing the left leg through a turning footplate. This component will help the impaired individuals with their hands, which encourages them to be autonomous on self-driving the vehicles. They can self-drive the vehicle or the auto himself can go over a long separation at the general speed. By building up this component this make them agreeable for the best possible driving the auto that they find troublesome some time recently.

5. WORKING PRINCIPLE

Fig.1: Working Setup

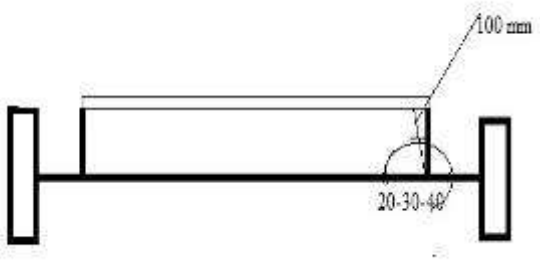
Disability is the repercussion of an impairment that can be mental, physical, emotional, vision, sensory or an amalgam of these. Disabilities have become a roadblock for disabled people to live a normal life. However, many of these impairments especially physical can affect the function of limbs. These can occur by birth or as a result of accident or an aftermath of a disease. This can affect the maneuverability of the people greatly. Due to this effect, they stand a great disadvantage in using public as well as private transportation facilities. Due to their disabilities, their level of being employable reduces and it affects them in becoming financially independent.

To overcome from this disability, we had design this model. In this project we had replaced steering wheel by pulley. Pulley is placed on lead screw .lead screw and first rack are fixed M.S. square pipe. First Rack is engaged to 1nd pinion. The working of rack and pinion is to transmit linear motion into rotating motion. At time of taking turn, driver rotates the pulley by foot in clockwise/anti clock wise direction, as per requirement. Pulley rotates the lead screw. Due to rotation lead screw move on left or right respective to direction of pulley rotation. Racks rotate the first pinion, pinions rotate the shaft and shafts rotate the 2^{nd} pinion.

Two pinions are on same shaft therefore rpm of these pinion will be same. 2^{nd} pinion is engaged to the 2^{nd} rack.

Main working of 2nd rack is give-required angle to tire for take turn. In this prototype drive is given by manually by rotating pedal with use of chain sprocket arrangement.

6. CALCULATION



Length travelled by rack for 30^0 rotations

Tan 30 = = $\frac{Opp}{Adj} = \frac{X}{100}$

X = 58 mm

For 30^0 of wheel rotation rack has to move 58mm

Pitch of rack = 5mm

No of teeth in engagement with rack and pinion = 2

So At a time rack will move 10 mm

So 6 teeth will engage with rack to move 58 mm

As 45 no of teeth on pinion each teeth will rotate = (360/45) = 8^0

6 teeth will rotate pinion by 48^0

Again upper rack will move 58 mm opposite to previous direction

Lead screw has to move 58 mm as rack moves

Pitch of lead screw = 7 mm

Rotations of screw = (58/7) = 8.28 rotations for single start threads

Angle of rotation	Length travelled by rack	Pitch of Rack	Teeth required to travel length	6 teeth will rotate pinion by	Length travelled by upper rack	Pitch of Lead Screw	Rotations of screw
20	36.39	5	4	32	36.39	7	5.19
30	58	5	6	48	58	7	8.28
40	83.90	5	8	64	83.90	7	11.99

1. Lead screw

Data:

Diameter of lead screw, D=20 mm

Diameter of internal diameter of wheel=d=25

Efficiency of lead screw=42%

Calculation

Lead =pitch*starts

=7*1

=7mm

We know that weight of leg is 24.7% of total weight of body. We assume maximum weight of driver is 80 kg

Therefore,

Weight of leg =80*24.7/100

=19.70 kg~20 kg

So the maximum load will be 20 kg

Torque produce on lead screw is,

Torque=$\frac{load*lead*efficiency}{2\pi}$

=$\frac{20*7*5*0.42}{2\pi}$

=46.79 N-mm

2. Rack and pinion

Given data:

T1=45

T2=2

D=40

R=20

Solution:

Module=$\frac{pitch}{\pi}$ =$\frac{5}{\pi}$=1.59=2

Addendum=m=2 mm

Least pressure angle to avoid interference:

Let,

Φ=least pressure angle to avoid interference

Addendum=$rsin^2\varphi$

$2=20sin^2\varphi$

Φ=18.434

Length of the arc of contact:

Length of the path of contact=$\sqrt{(r+addendum)^2-(rcos\emptyset)^2}$

=$\sqrt{(20+2)^2-(20cos18.434)^2}$

=11.13 mm

Therefore,

Length of the arc of contact=$\frac{length\ of\ the\ path\ of\ contact}{cos\emptyset}$

=11.73 mm

Minimum no. Of teeth:

Circular pitch=$P_c=\pi d/t$

=π*40/20

=6.28 mm

Therefore,

The no. of pairs of teeth in contact=$\frac{length\ of\ arc\ of\ contact}{circular\ pitch}$

=11.73/6.28
=1.78

So minimum no. of teeth in contact is 2or **1** pair.

Pinion

Power transmitted=$\frac{2\pi NT}{60}$

=$\frac{2\pi NT}{60}$

=6.8 W

Torsional moment=$\frac{60*10^6*kW}{2\pi n}$

=$\frac{60*10^6*6.5*10^{\wedge}-3}{2\pi*1}$

=14026N-mm

Tangential force act on pinion=P_t=$\frac{2Mt}{d}$

=2*14026/4

=701.3 N

Radial force act on pinion=P_r= $P_t$tanὰ

=701.3*tan20

=255 N

Addendum =h_f=m=2mm

Dedendum(h_f)=1.25 m=1.25*2=2.5mm

Clearance(C)=0.25*m=0.25*2=0.5mm

Working Depth (h_k)=2m=4mm

Whole depth (h)=2.25m=2.25*2=4.5mm

Tooth thickness(s) =1.5708m=3.1416mm

Tooth space=1.5708 m=3.1416mm

Fillet radius=0.4 m=0.8 mm

3. Frame design:

Cross section=1"*1"

Material=M.S

E=210 GPa

Max.wt=20 kg

Syt=400 N/mm^2

Permissible shear stress:

τ=$\frac{Syt}{fos}$=$\frac{400}{2.5}$

=160 N/mm^2

Solution:

Area=outer area-inner area

=BD^2-bd^2

=25.4^2-19.4^2

=268.8 mm^2

B=D=1"=25.4 mm

Thickness=t=3mm

B=d=25.4-3*2=19.4 mm

Moment of inertia,

I=$\frac{(BD^3-bd^3)}{12}$

=$\frac{(25.4^4-19.4^4)}{12}$

= 22882.048 mm^4

Y=D/2=25.4/2=12.7 mm

We know that,

τ=$\frac{SAY}{I}$

=$\frac{196.2*268.8*12.7}{22882.048}$

=29.27<160 N/mm^2

7. CONCLISION

In this venture we have considered and executed a foot worked controlling framework for physically tested armless individuals. This gadget is effectively intended to give a more noteworthy preferred standpoint to physically tested individuals. We can achieve that most extreme speed of the auto is 40 km/hour. As the framework is cumbersome the efficiency diminishes, however this influence is immaterial. The framework is just pertinent to naturally determined autos and accordingly reasonable for long separation transport.

REFERENSES

[1] Arun Raju C, Anish Raman C, Veerappan K.R.Venkat Narayanan; "Dual steered three wheeler for differently able people", European Scientific Journal May 2014 edition vol.10, no.15 Issn: 1857 – 7881 (print) e - Issn 1857- 7431.

[2] Arun Manohar Gurrama, P.S.V Ramana Rao, Raghuveer Dontikurtia; "Solar powered wheel chair: Mobility for physically challenged", International journal on current engineering and technology, vol.2, no.1 (March 2012).

[3] Major General Vijay P Pawar and Dr George Judah, A Study on the Rehabilitation Facilities Provided by the Government to People with Disabilities & Its Awareness in the Society, International Journal of Management, Volume 5, Issue 8, 2014, pp. 16 - 24.

[4] V.B.Bhandari;"Design of machine elements", Reference book.