FOOT OPERATED VEHICLE FOR ARMLESS PEOPLE

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Abstract

Aim of our project outlines the entire design and working of the "foot operated vehicle" throughout the semester. The contents include a description of the design and selection process including all important information about the vehicle. Due to rapid industrialization and development of the economy the expectation of the customer and their ability and willingness to pay for the product has changed drastically.

Keywords: Foot controlled steering, Handicapped, Steering system

1. INTRODUCTION

Everyone has their own vehicle and people with all body parts are fortunate. It is unfortunate for partially disable people with hands. Disability is the repercussion of an impairment which can be mental, physical, emotional, vision, sensory. Disabilities can occur in upper extremities and in lower extremities. These people become more dependents and lose their confidence. Due to this effect, they stand a great disadvantage in using public as well as private transportation facilities. Foot Operated Steering vehicle was something new to come up with and we had an interest to make something innovative. The main objective of the project is to design a foot operated system for handicapped people. To suit the requirements of disabled drivers with these special circumstances, this high technology solution allows for the vehicle to be steered using the left leg through a rotating footplate. There is no use of the arms in using primary driving controls.

2. General Information

a. Design Of Frame:

In the first step we have designed the frame of the project Frame is a skeleton upon which parts like engine are mounted. So it is important that the frame should not buckle on uneven road surface.

We have designed "ROLL CAGE" frame.

Material Used For Frame: Mild Steel.

b. **Suspension System:**

Suspension allows relative motion in cars. The design of spring is to verify by using customize package of ANSYS to perform finite element analysis. The static stress analysis is Perform and the results are comparing with theoretical calculations. Double Wishbone Suspension is an independent suspension design using two (occasionally parallel) wishbone-shaped arms to locate the wheel. Each wishbone or arm has two mounting points to the chassis and one joint at the knuckle.

c. Steering System:

Rack & pinion is on the vast majority of today's vehicles, and has been for the last few decades. It's simple, compact, direct, and provides great steering feel. On this type of system, a toothed pinion gear mounted on the bottom of your steering column turns with the steering wheel. As that pinion gear rotates, it comes in contact with the "rack" (a long bar with teeth cut into it) – causing the rack to slide left or right. As the rack bar moves, your front wheels turn accordingly.

d. Braking System:

An internal expanding brake consists of two shoes S1 and S2. The outer surface of the shoes are lined with some friction material (usually with Ferodo) to increase the coefficient of friction and to prevent wearing away of the metal. Each shoe is pivoted at one end about a fixed fulcrum O1and O2 and made to contact a cam at the other end. When the cam rotates, the shoes are pushed outwards against the rim of the drum. The friction between the shoes and the drum produces the braking torque and hence reduces the speed of the drum. The shoes are normally held in off position by a spring. The drum encloses the entire mechanism to keep out dust and moisture. This type of brake is commonly used in motor cars and light trucks.

e. Power System (Electric Power System):

Battery: Lead Acid Battery is used in this electric car.

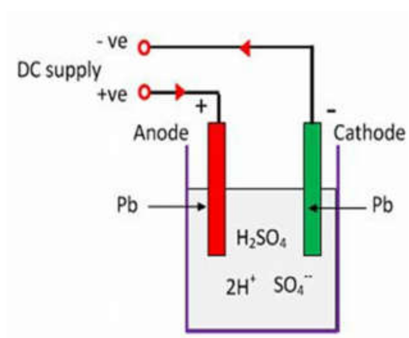

Figure 1: Lead Acid Cell Battery

3. Calculation

1. Torque Calculation(Required Torque):

Factors Affecting the Required Torque

When selecting drive motor for the electric vehicle, a number of factors must be taken into account to determine the maximum torque required. These factors are:

1. Rolling resistance

2. Grade resistance

3. Acceleration force

$$F=mg \tag{1}$$

1.1 Calculating the Rolling Resistance (R_r):

Rolling resistance is the opposing force that the vehicle has to overcome due to the rolling motion between the wheels and the surface of motion of the vehicle. the rolling resistance depends on the co-efficient of rolling friction which varies depending upon the material of tires and the roughness of the surface of motion the rolling resistance can be calculated as:

$$R_r=GCV*Cr_r \tag{2}$$

1.2 Calculating the Grade Resistance (G_r) :

Grade resistance is the form of gravitational force. It is the force that tends to pull the vehicle back when it is climbing an inclined surface. The grade resistance acting on the vehicle can be calculated as:

$$G_r=GVW*\sin\theta \tag{3}$$

1.3 Calculating Acceleration Force (F_a)

Acceleration force is the force that helps the vehicle to reach a predefined speed form rest in a specified period of time. The motor torque bears a direct relationship with the acceleration force. Better the torque, lesser the time required by the vehicle to reach a given speed. The acceleration force is a function of the mass of the vehicle. Acceleration force is calculated as:

$$F_a=m*a \tag{4}$$

$$m=GCV/g \tag{5}$$

1.4 Calculating Total Tractive Effort

$$TTE=R_r+G_r+F_a \tag{6}$$

1.5 Calculating Torque

$$T=R_f * TTE * r \tag{7}$$

1.6 Calculation of Actual Torque

$$P=2\pi NT/60 \tag{8}$$

2. Calculation of Design of Suspension

2.1 Design of spring

$$K_w = (4C-1/4C-4)+(0.615/C) \tag{9}$$

$$D=C*d \tag{10}$$

$$K = Fmax/ʃmax \quad (11)$$

$$K = Gd/8C^3n \quad (12)$$

2.2 Solid Length

$$L_s = n'*d \quad (13)$$

2.3 Free Length

$$L_f = L_s + ʃmax + (n'-1)*1 \quad (14)$$

4. Abbreviations

F = Gross weight of Vehicle.

g = Gravity.

M = mass of the vehicle.

R_r = Rolling Resistance

GCV = Gross Vehicle Weight

Cr_r = Co-eff of Roller Resistance

Assumption

"Cr_r value for concrete surface in fair condition"

θ = 900 assumed on plane surface.

F_a = Acceleration Force.

R_f = Friction Factor for Cylindrical Ball Bearing

r = Wheel Radius

Assumption

R_f = 0.013

P = Power

N = Speed

T = Torque

F = Force on one wheel

C = Spring index.

K_w = Wahl's Factor.

D = Coil Diameter

d = wire diameter

Assumption

Spring is Square & Ground end

n’ = 9+2

5. Figures

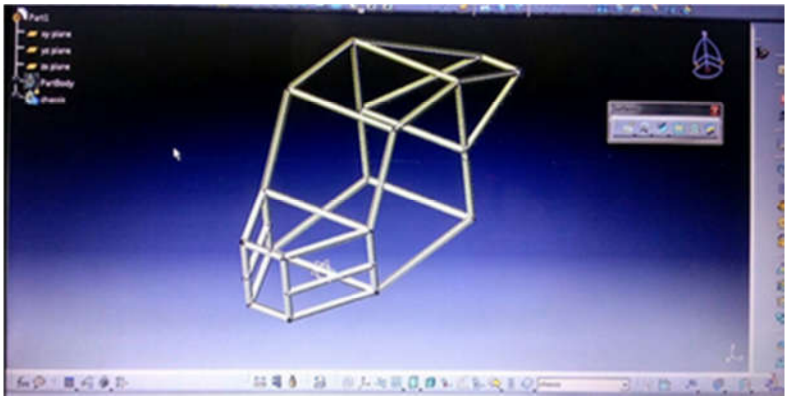

Fig 4: Frame

Fig 5: Assembly

6. References

1) International Engineering Research Journal (IERJ) Special Issue 3 Page 394-396, 2016, ISSN 2395-1621© 2015, IERJ All Rights Reserved Page 1,Foot Operated Steering Mechanism,#1Mandar Patil, #2Prashant Pawar #3Swapnil Patil #4Swapnil Honrao.
2) International Journal of Mechanical Engineering and Technology (IJMET) Volume 6, Issue 12, Dec 2015, Pp. 66-72, Article Id: Ijmet_06_12_007 Designing And Manufacturing Of "Foot Operated Steering" For Disabled People Mandar Soman, Sumit Sonekar, Saurabh Upadhye
3) IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 9, 2015 Handfree Vehicle for Disabled Kumbhar Vikas , Nagane Swapnil , Patil Suraj, Pawar Rohit .
4) International Journal Of Research In Aeronautical And Mechanical Engineering Vol.2 Issue.3,March 2014. International Journal Of Research In Aeronautical And Mechanical Engineering Review On Tadpole Design – Issues & Challenges ,Palash Patodi ,Vinay Saxena ,Yogesh Rathore.
5) Computers Inbiologyandmedicine77(2016)148–155, Toward brain-Actuated car applications:Self-Paced control With A motor imagery-Based brain-Computer interface Yangyu A, Zongtan zhou A, Er weiyin B, Junjiang A,C, Jingshengtang A, Yadongliu A,Dewenhu A,N
6) International Journal of Mechanical and Industrial Technology ISSN 2348-7593, Vol. 5, Issue 1, pp: (66-69), Month: April - September 2017, Foot Controlled Steering System
Mr. Praveen D Dethan, Syam M Nair, Nandu Vijayakumar , Sarath Kumar S, Vishnu S