



## Design and Implementation of tricycle for handicapped person

Sorathiya Mehul<sup>1</sup>, Utkarsh Prajapati<sup>2</sup>

<sup>1,2</sup>Assistant Professor, Mechanical Department, Sigma institute of Engineering, Vadodara, Gujarat, India.

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**Abstract:** Modified tricycle for handicapped person is based on assisting and supporting handicapped individuals with one functional leg and one functional hand to easily ride bicycle and to make them feel confident performing work like healthy person. In this paper the conventional tricycle design was improved and some of its parts were modified in order to suit the utilization by such category of the people. The design put into consideration that they are not similar to healthy person in terms of strength, balance and flexibility, thus modification were done in a way to suit ease of usage, and balance to avoid falling and to feel them like a normal person.

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**Key Words:** tricycle, rack pinion, sewing machine, handicapped person, gear mechanism

### I. INTRODUCTION

Focusing on the design of an advanced wheelchair and tricycle, this project investigates devices available to handicapped users and looks at the design of a modern, performance option aiming to improve the usability of a tricycle by making it no longer necessary to leave the wheelchair to experience the attributes of a purpose built recumbent tricycle.

The design process is worked through and finite element analysis begun, along with a look into manufacturing options for both workshop and commercial production. One of the most important services that could be provided for the handicapped in terms of movements is how to find means of transportation that can assist him to serve himself and to dispense the help of others. From this point the team started to think about suitable means that could be used by the disabled person in order to assist them in their physical activities. This paper is basically for handicapped person those who are having one functioning hand and one leg. Purpose for making this project for handicapped person is to make the handicapped person feel like a healthy person and normal leaving person. There are many handicapped person tri-cycle in market but our tricycle is basically having rack and pinion mechanism, which is an different mechanism and which makes the driver comfortable in driving the tri-cycle and low maintenance cost. Our previous mechanism was working on sewing machine mechanism, but this mechanism was complex and hard in working. Besides not using this mechanism in our tri-cycle was increase in weight and fatigue problem in driver leg. So due to this problem and complex mechanism we have not use this mechanism.

### II. LITERATURE REVIEW

**K. Kalyani Radha, K.Sai Kiran** described the tricycles are used for transportation, possessing discomfort with physical exertion required to pedal over roads and uneven terrains to the physically challenged people with traditional tricycles which are arranged with extremely high gear ratio. A power assist could go a long way toward improving tricycle comfort and ease of use for drivers by easing the burden on the disabled person. The tricycle is designed and fabricated with new drive trains arranged to have low gear ratio giving a solution to minimize the constraints and problems over the traditional tricycle.

**Surajkumar Reddy, Hemant Sinha, V.Venkatraju, M.Sathish, Dr.S.Ranganathan** described Modified Tricycle for Handicapped people" is a paper based on assisting and supporting handicapped individuals with one functional leg to easily ride bicycles and to make them feel confident performing work like healthy people. In this project the conventional Tricycle design was improved and some of its parts were modified in order to suit the utilization by such category of people.. The design put into consideration that they are not similar to healthy people in terms of strength, balance and flexibility, thus modifications were done in a way to suit ease of usage, and balance to avoid falling. These modifications were applied on three main parts of the conventional bicycle. The parts that causes difficulties were adjusted using CATIA software to work as supporting units as well as facilitating usage of the "Modified Tricycle for Handicapped people" by such individuals.

**Snehal and Amit (3)** developed the solar tricycle especially for the handicapped person. In this paper discussed that how solar power is utilized for providing the power to the tricycle, which will reduce the efforts of the handicapped person. The solar tricycle mainly consists of Solar panel, Brushless DC motor, Battery, Charge controller and Throttle. This paper includes all the information regarding the solar powered tricycle and its main components used in it.

**Abhishek K. Saw and Pratik Dhote (4)** described the solar power tricycle project and includes the methods and considerations regarding the proper working of the tricycle. The main content of this paper is Solar PV panel, Brushless PMDC motor, Charge controller and battery. This paper will discuss about the main idea of the component and here we compared the different component.

### III. DESIGN AND MODIFICATION

Based on literature review tri-cycle for physical Handicapped person available in market which is manually operated and its working like that.



*Figure 1. Simple Mechanism Tricycle*

- Tricycle shown in above picture is operated by both hands.
- Left hand is used for handling and braking while right hand is used for paddling cycle.
- In this tricycle one gear is connected to hand paddle and other gear is to rear wheel, power from hand paddle to rear wheel is done by connecting chain between both gears.
- Since this tricycle is manually operated by only hands. Our objective is that it should be operated by the person having one hand and one leg functioning so prepare model as per objective and made modification in tri-cycle design and its mechanism as shown in picture.

#### 3.1 Modification in Tricycle



*Figure 2. Tricycle with sewing machine mechanism*

- The above tricycle works on a principle of sewing machine where powered by a treadle mechanism. The treadle was operated by pressing down on it with a foot, or both feet, to cause an oscillating movement.
- This movement spins a large wheel on the treadle frame, connected by a thin leather belt to a smaller driving wheel on the sewing machine.

### **3.1.1 Problem faced in above modification:**

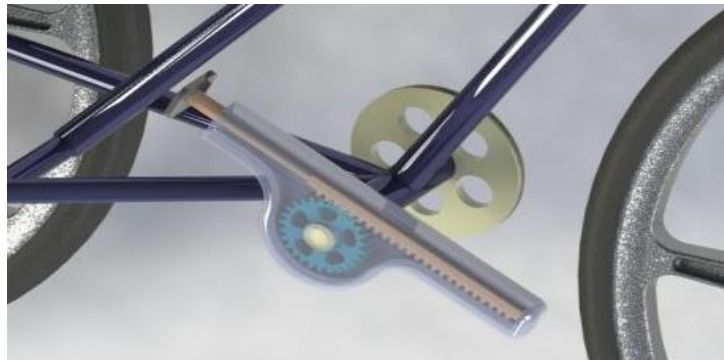
- complicated mechanism.
- more fatigue to person.
- high maintenance due to more moving parts.
- more frictional losses.
- More weight.

### **3.1.2 To Overcome the above given Problem:**

- Due to this friction loss reduces
- Tri-cycle working on rack and pinion gear mechanism
- Maintenance is reduced
- Weight is reduced

## **3.2 Rack and pinion mechanism and its working:**

- When the pedal is pressed down in a linear motion by the handicapped, the toothed pole moves and this causes the gear to move in a circular motion. This is connected to gear on the same axle through a spindle.
- Gear shifts and transmits the motion to gear through the chain connected between them. The gear transmit the motion to gear through the chain connecting between them. Then the movement is then shifted to the rear wheel through the spindle connecting between them, which attached to gear. The foot must then be removed of the pressed state of the pedal.

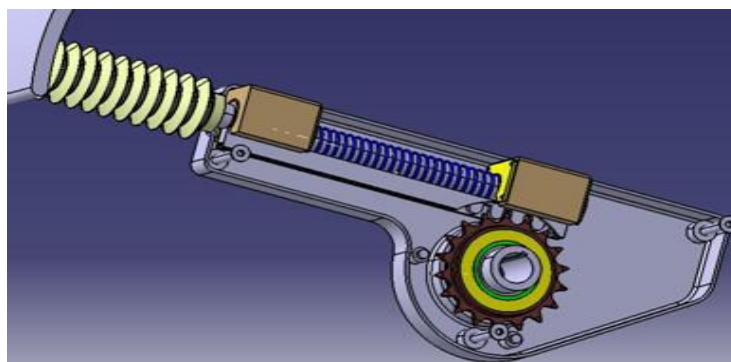


**Figure 3. Rack and Pinion Mechanism**

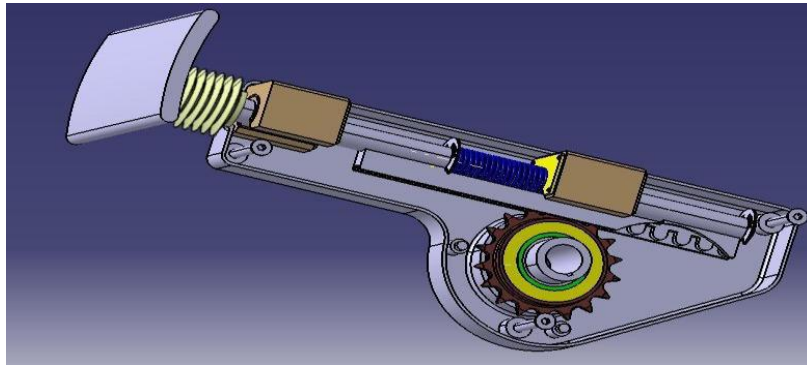
## **IV. IMPLEMENTATION**

### **4.1 Rack and pinion mechanism:**

- The mechanism is designed to transform linear motion to a circular one, then transforming the latter in the lines direction of motion.
- This is an simple and less complex mechanism, which propelled the tri-cycle smoothly.
- The main feature of this mechanism is it has low maintenance cost and due to this feature lower and middle class people can easily accommodate
- In future, we can also change the side of paddling as per the requirement and this helps a lot. So that's why we preferred this mechanism.

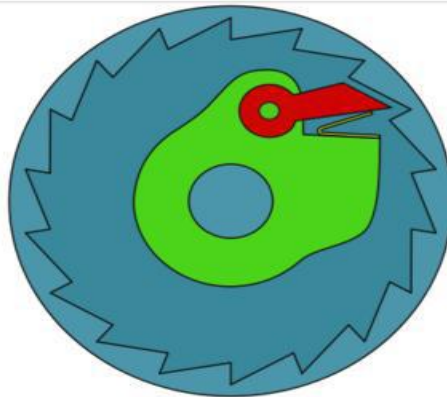


**Figure 4. Rack and Pinion Mechanism at rest position**



**Figure 5. Rack and Pinion Mechanism Pressed Position**

## 4.2 REAR WHEEL GEAR MECHANISM



**Figure 6. Rear Wheel Gear Mechanism**

This mechanism transmit torque in forward direction only and in reverse direction it rotate freely

## V. CALCULATION

### 5.1 torque calculation

#### 5..1.1 Input parameters

Gear ratio = (front sprocket/rear sprocket) = (36/18) = 2

Stroke length = 0.3 m

Wheel radius = 0.33 m

Weight of Tri-cycle = 25 kg

Effort required to pedal is given by :

$$= \{(\text{Load on drive wheels}) \times (\text{gear ratio})\} \times \{(\text{wheel radius/stroke length})\}$$

Effort = 5 kg

Torque on pedal is given by :

$$= (\text{effort required} \times \text{stroke length} \times \text{gravitational force})$$

Torque = Force X distance

Force=Torque/Distance

Spring Stiffness (K) :

Spring Stiffness for 1kg of load applied,

Weight = 1kg

x = deflection of spring =0.5 cm

Force = 9.81N

$$\text{Now } K = f/x$$

$$K= 19.12 \text{ N/M}$$

### 5.2 Calculation table:

**Table.1 Result Table**

| Sr. no | Weight of rider | Initial Effort Req (kg) | Torque (N-m) | Force ( N ) |
|--------|-----------------|-------------------------|--------------|-------------|
| 1      | 45              | 5                       | 14715        | 3.20        |
| 2      | 50              | 6                       | 17.658       | 4.441       |
| 3      | 60              | 8                       | 23.545       | 5.886       |
| 4      | 85              | 10                      | 29.43        | 7.3575      |

### 5.3 Final model



**Figure 7. Design Model of handicapped tri-cycle**

## VI. CONCLUSION

So based on design and calculation “Modified Tricycle for Handicapped People and completing the model for developed parts to enable the handicapped to use it, there are severely recommendations which could be achieved in the future.

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