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Modified Tricycle for Disabled People

Engineering

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ABSTRACT

Modified Tricycle for Disabled people" is a paper based on assisting and supporting disabled 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 Disabled people" by such individuals.

INTRODUCTION

Man lives in this world pursuing life in order to earn his living, Times go by day after day and we have to remember to think about people who are deprived from many things. There are our community's individuals who are deprived of legs, hands or other part of the body, we might not know how to support them. This is where the idea of the project was initiated and suggested by the project supervisor.

Disabled people have on importance in the society as people need to stand beside them for their special needs, care about their feelings, and make life easy for them in order for them to depend on themselves. One of the most important services that could be provided for the disabled in terms of movements is how to find means of transportation that can assist him to serve himself and to dispend the help of others. From this point the team started to think about suitable means that could be used by the disable person in order to assist them in their physical activities.After our initial searches and inquiries the team adopted conventional bicycle as the most suitable means, because of it's:

1) Low cost, easy attainability and affordability by the disabled.
2) Small size, ease of movement and transportation ability.
3) Simplicity of parts and easy assembly.
4) Widespread usage by all age categories (children, youth and the elderly).

This project focuses on a specific disabled category, who are single legged people.

The process was initiated by searching for studies and research regarding developing regular bicycles with the purpose to suit the single - legged person. We found many simple ideas to serve such category, however, they were personal endeavors not supported by states or organizations and not documented in scientific research.

BACKGROUND

First we examine the different parts of a bicycle so the reader can completely understand how this machine works.

1.2.1 Bicycle Parts:

In order to talk about bicycles, it's good to start by naming all of the parts. Here's a picture of a typical bicycle. Bicycles are made of just a few parts that you can immediately see and identify. The core is the frame. A bicycle's frame is made of metal tubes welded together. Each tube has a name.

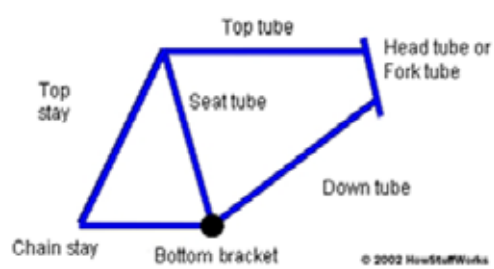


Fig 1.3 - Frame

Other parts include the following:

- The front fork is the movable part of the frame that holds the front wheel.
- The wheels - The wheels are made of a hub, the spokes, the metal rim and the rubber tire.
- The seat and seat post.
- The handlebars and the handlebar stem that connects the handlebars to the frame.
- The cranks and the pedals.
- Thebrakes, consisting of the actuators on the handlebars, the brake cable, the brake calipers and the brake pads.
- The chain and gears, consisting of the front chain wheels, the rear freewheel, the front and rear derailleur, the shift levers on the handlebars and the cables.

Construction

Below is the detailed outline of the construction process we used. Each section is accompanied by a detailed schematic diagram detailing the dimensions of the materials used as well as pictures taken during construction.

2.2 COMPONENTS:

2.2.1 FRAME WORK

Dimensions: Overall length - 1970 - 2010 mm

Overall width - 970 - 1010 mm

Overall height - 970- 1010 mm

25mm O.D - E.R.W. (Electric resistance welding) Pipe



Fig 2.1 Framework 1



Fig 2.2 Framework 2

1.1.2 STEERING SPROCKET - PEDAL

Upper 22 teeth sprocket & Lower 18 teeth free wheel



Fig 2.3 Pedal Design **Fig 2.4 Pedal**

1.1.3 WHEEL RIMS

- Wheel rims for the tricycle shall be of size 28 inch x 1.5 inch.
- The spokes shall be of 2.00 mm normal dia.
- There shall be 32 spokes in the front wheel and 40 spokes in each of the rear wheels.
- When assembled the spokes shall cross without touching each other.

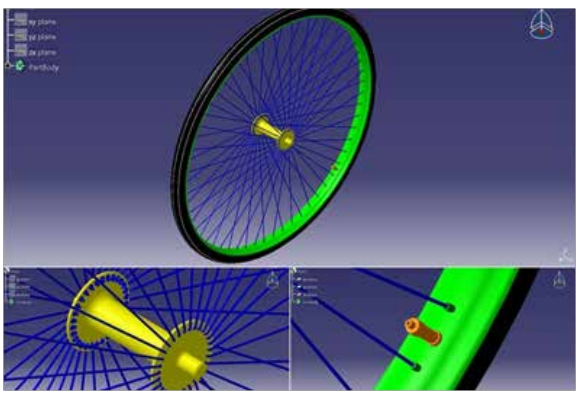


Fig 2.5 Rim and Spokes Design

1.1.4 TYRES AND TUBES

Tyres and tubes of required dimension for the rim of 28" and 1.5"



Fig 2.6 Tyre and Tube

1.1.5 MUDGUARDS

- The mudguards of minimum 0.45 mm thick MS sheets shall be provided with beaded edges.



Fig 2.7 Mudguards

1.1.6 BRAKES

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- Brakes shall be provided to both the rear wheels of tricycle which shall be capable of applying by pulling the handle bar upwards.
- Brakes shall be effective and easy to operate.



Fig 2.8 Braking Clamps

1.1.7 DRIVE CHAIN

Avon/ Metro (ISI Marked) – 1 1/2 Bicycle chain (204 links)

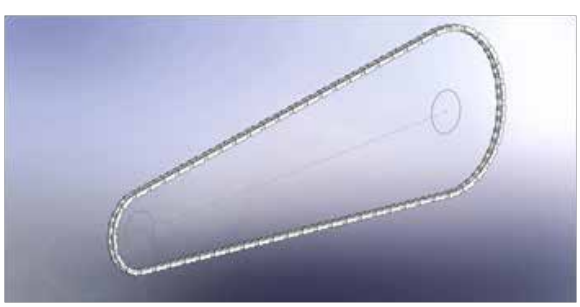


Fig 2.9 Chain Design

1.1.8 SEAT AND BACKREST

Wooden based and Seat cushion with Foam.

1.1.9 ACCESSORIES

Following items can be additionally added as normal accessories.

a) Bell/ Horn.

b) Locking arrangement.

c) Red reflectors.

PROBLEM DESCRIPTION AND TECHNICAL INFORMATION

After us studying the mechanism of the bicycle and its individual parts, we defined the parts that can be modified in order to suit the disabled one-legged individual. The equation is:

Why cannot an individual with one leg ride a bicycle? The answer to this question will lead us to know the parts that need to be developed in the bicycle to enable the one legged individual to use it.

3.2 WORKING

- Since it is hand powered tricycle, the power is given by pedaling the sprocket with the help of the hands.
- As it is pedaled, there is a chain drive link between the gears at the hand the forward wheel.
- This initiates the movement in the forward wheel.
- Initially, more force is required to pull the vehicle from rest position.
- As the vehicle is in motion, the force required will be less to continue the motion.
- Acceleration can be done as per the rider's stamina and ability.
- Direction and steering the vehicle can be done with the help of the pedal rod in a single setup.
- Both the steering and the movement of the tricycle can be controlled by the user in a one single setup.

3.3 DESIGN CONSTRAINTS

Obstacles facing a one-legged individual include:

1) Balance: an individual with one leg is deprived of balance because of pressing the pedal only on one side, which may cause him to fall.
2) The chain cannot complete the round with one leg only.
3) The great difficulty of a one-legged individual to sit on a small seat as the one in a bicycle.

These reasons impede the one-legged individual from using normal bicycle. After studying these reasons and investigating their details we suggest the following modifications:

2 Designing a bicycle with three wheels (adding one rear wheel):

This enables of an individual with one leg to have balance whether at the onset riding (to avoid assistance in riding) or while riding the bicycle.

3 Replacing the function of the dysfunctional leg with the idea of a motion system which could perform a full-gear round with only one pedal.

Replacing the bike seat with a seat in the form of a chair since such seat will prevent the disabled from falling, particularly in corners and runs.

3.4 DESCRIPTION OF METHODOLOGY AND SOLUTION

To start we have identified the conditions that should be available in the bike of which are: comfort, fall prevention and ease of use for the one legged handicapped. The following features should be available:

1) We propose there should be two rear wheels that provide balance for the driver, providing safety against falling.

2) To address comfort, we propose that:

a. The seat: should move in different directions, from top to bottom and from front to rear. It should also be able to move at an angle, and to turn at an angle in order that the handicapped can easily ride the bike.

b. The steering: should be movable at an angle to different positions including top to down, and front to rear.

3) To address versatility: a feature is to be added that the one-legged person can use motion system either for the right or left leg.

To bring the work to reality the next step was to:

The team started collecting information concerning these design aspects from different sources and the assistance of the Professor supervising the project. Previous ideas include:

a. Hand pedals connected to the steering wheel: such idea is so exhaustive for the disabled as all the bike works done by hands (pedaling, controlling the steering wheel, brakes). Also, the resulting speed is significantly low.



CONCLUSIONS

In finishing the project "Modified Tricycle for Disabled 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. Recommendations include:

1- Making a dynamic simulation:

This we were not able to do due to little experience in the program of Dynamic Simulation and tight time to learn such programs as use had not dealt with this before. Thus, we recommend performing dynamic simulation by those who want to complete the project after us or be a subject for one of us for the Master degree.

2- Making a physical model of the product to determine its performance in reality, as well as to see whether its look is acceptable. By making the model we will discover defects that can only be detected by using and trying it.

3- Conduct a study on the number of those who are in need of such a model in the Kingdom. We tried to obtain numbers, studies and statistics on this category of handicapped we were surprised that no there such statistics were available with the governmental or humanitarian organizations for types of disabilities.

4- Calculation of the product cost and whether it will affordable for all design categories, as well as trying to reduce its cost.

5- Testing of the model after its manufacture and its trial by a group of handicapped to see whether there is any difficulty in its use and its development until it suits all their needs.

The project addressed the need of the handicapped for moving by using the bike. We developed by changing parts to make of a conventional bicycle for the handicapped tricycle. The parts being developed, included was adjusted the seat which accessible to move horizontally and vertically, as well as to turn enable the handicapped to ride the bike at ease. This also helps him to press the movement system from suitable distance according to the leg length. We also adjusted the steering and made it possible to move closer to the rider and accordingly changed movement system in order to suit the leg length and the possibility to shift it to any of the two sides (right or left) according to the handicap's functional leg. Another wheel was at the rear to maintain balance. Afterwards we used CATIA and AUTO CAD programs to enable simulation of to scale as well as the possibility of development and dimensions calculation as well.

Finally, we hope that this project has done its purpose in providing a potential solution for independent, efficient transportation of one-legged handicapped by means of a tricycle for handicapped people.