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To Reduce Driving Effort of Tricycle by Implementing Changes in Brake and Radius of Wheel Combination

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Abstract:- Motion vehicles are designed based on the usage, i.e. either indoor or outdoor. The cost of vehicle may not be reasonable for a common man. So the focus is laid on the simplicity in design, high performance, easy maintenance & safety at very reasonable price. Details component used and designing factors while designing the tricycle has been provide in this paper. This tricycle is very resourcefully designed and can be proved as a better replacement for the original models used by the handicapped keeping in mind the factors such as safety, cost of production and performance of tricycle. In this tricycle we have worked on the braking system and wheel diameter. We have applied the centralized braking system ,as it reduces the vibration and will be helpful while stopping the vehicle and will not allow to skid the vehicle And it's operation works on combine braking system single lever operated, which is mounted centrally bye linkages. And the wheel diameter of the front wheel is kept small as it reduces the effort and torque. This tricycle especially for handicapped person of ANANDVAN organization started by Dr. Baba Amte in Warora taluka of Maharashtra state (India). The association is working for the leprosy affected people. In this paper it is discussed that how tricycle will help to reduce the effort of handicapped person. All the designs requirement measured after analyzing the complications from the handicapped person. Ease of the person in the tricycle is an important and we have given importance to it.

Keywords:- *Cost, Safety, Design, Braking system, Wheel diameter, Performance.*

I. INTRODUCTION

Transportation is one of the important sources for increasing flexibility of human. In transportation, vehicles play a very critical role. Normal human being uses these vehicles very easily but for a disabled person it is very problematic. Nowadays various hand driven tricycles are available for them but these are designed predominantly for the basic functional use for moving on road without considering many important features of safety, ergonomic aspects and aesthetics.

The design of tricycle is an upgrading on the existing ones. It is carried out to benefit the user suitably, physically, and restfully such that when a little effort is exercised, a greater output (effort) is achieved as a result of the fast transmission produced by the chain drive mechanism. In this project, chain drive mechanism is using which permits the user much more resourceful momentum than would be provided by the hand pedal wheelchair.
The project's goalmouth is to provide a good living situation for people considered to be bodily challenged (spiked), to transport themselves around their atmosphere.

After our preliminary searches and studies the team implemented conventional tricycle as the most suitable means, because of it's:

- Acceptable cost, Medium attainability and affordability by the disabled.
- Medium size, comfort of movement and transference ability.
- Effortlessness of parts and easy gathering.
- Extensive usage by all age groups(children, youth and the elders).

This project emphases on a specific disabled group, who are suffering from leprosy leg problematic people.
The process was originated by searching for studies and research regarding evolving regular tricycles with the purpose to outfit the without legged person. We found many simple ideas to aid such category, however, they were own happenings not supported by states or administrations and not recognized in scientific research.

II. PROBLEM DEFINITIONS

- To develop a distinctive, cost-effective, purpose allocation tricycle for disabled person.
- To design and fabricate a tricycle for disabled person for permitting the disabled person to drive less energy while driving on mounting road conditions.

III. HISTORY

A three-wheeled chair was built in 1655 or 1680 by a disabled German man, Stephan Farffler, who needed to be able to preserve his elasticity. Since he was a watch-maker, he was able to generate a vehicle that was power-driven by hand cranks.

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In year 1789, two French planners established a three-wheeled vehicle, driven by pedals; they called it the tricycle.

In 1818, British inventor Denis Johnson patented his approach to designing tricycles. In 1876, James Starley established the Coventry Lever Tricycle, which used two medium wheels on the right hand side and a large drive wheel on the left hand side; power was supplied by hand levers. In 1877, Starley established a new vehicle he called the Coventry Rotary, which was "one of the first rotary chain drive tricycles." Starley's inventions started a recycling craze in Britain.By 1879, there were "twenty types of tricycles and multi-wheel cycles ... produced in Coventry.

England, and by 1884, there were over 120 different models formed by 20 manufacturers."

First front steering tricycle was manufactured in 1881 by The Leicester Safety Tricycle Company of Leicester, England, which was brought to the market in 1882 costing £18. They also established a folding tricycle at the same time.

Tricycles were used by riders who did not feel comfortable on the high wheelers, such as women who wore long, flowing dresses.

IV. FIELD SURVEY

In order to get a basic idea of the day to day complications faced by disabled people for carriage and conveyance, Field Survey is carried out. Also a visit was directed to **ANANDWAN**, WARORA, CHANDRAPUR (MAHARASHTRA)and some efforts concerning the project from the disabled people leaving in the **ANANDWAN** were prominent down in the field survey sheet. Following are the inputs grouped:

- Vehicle should be cost effective.
- Vehicle should be easy to operate.
- Manual shifting of gears should not be there.
- Efforts required to run the tricycle on ascent roads should be minimum.
- A disabled should be able to climb up on the tricycle without getting help from other person.
- Sufficient space should be provided so that hands or other body parts will not touch the vehicle body.
- Functional controls of the vehicle should be within the reach.
- Vehicle should be stable (should not move) at the time of climbing the person.

V. MATERIAL SELECTION

While selecting the material for production, chief purpose is to select material that can provide high strength and dependability to the tricycle. Another deliberation is to reduce material charge and overall weight of tricycle. Some required properties of material required for production of model are :-

- Material should have high tensile strength.
- Material should bear torsional and shear stresses.
- Material should be highly resilient to changing weather conditions.
- Material should be light in weight.
- Material should be cost-effective & economical.

As the application includes various forces and moments on the fabricated model, the material selected must be either metal rods or tubes for safety and efficient working. Mild Steel provides high tensile and torsional strength required for the application. Hence, Mild Steel is designated.

Properties of Mild Steel

Properties	Value
Density	7.7- 8.03 gm/cm^3
Elastic modulus	190-210 GPa
Poisson's ratio	0.27-0.3
Tensile strength	615.4 MPa
Yield strength	400 MPa
Hardness	179 HB
Impact strength	6.1 J

Table 1. Material Specifications

VI. CONSTRUCTION

Below is the meticulous outline of the construction process weused. Each section is convoyed by a complete schematic diagram specifying the dimensions of the materials used as well as pictures taken during construction.

Framework

A. Wheel Rim

• 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.

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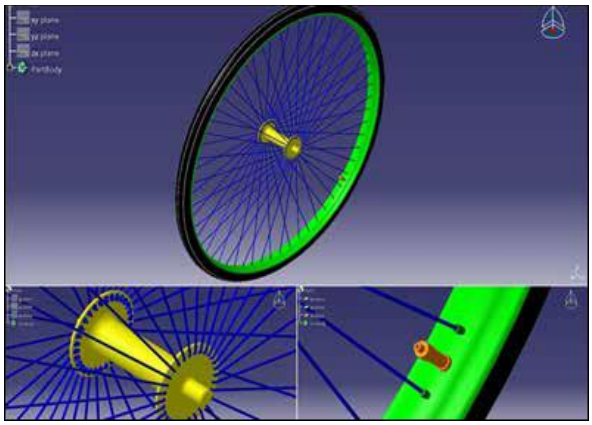

Fig :-1 Wheel rim

B. Raw Material used:
"Mild steel" hollow bar of length 20 feet and diameter 1inch.

C. Equipment Used:
- Measuring Tape: Carpentry tape
- Marker: Chalk
- Cutting machine: Electrically functioned grinder cutter machine
- Bending Machine: Manually worked jaw bend
- Welding: Electric arc welding
- Finishing Tool: Grinder

D. Procedure
Measurement: Measured the given pipe and found that length is 20 feet and diameter is 1inch.

Marking: Marked two section of length 31inch namely A
Cutting: Cut down the marked lengthwith cutter
Marking: Marked two section of length 32inch namely B
Cutting: Cut down the marked length with cutter.

Marking

S.N	Bar name	Length (inch)	No of pieces
1	C	17.75	01
2	D	18.5	01
3	E	4	02
4	F	28	01

*Bending***:** Manual metal cutting sow
Marked bars A and B at a distance 12inch from one end.
Cut the marked point slightly diametrically using manual metal cutting sow
Bend bars A and B to make corner distance 30inch.

E. Assembly:
- Join one end of bar A and bar B with bar E.
- Repeat the same for another pair of bar A and B.
- Join another ends of bar B with bar F keeping bar B as outer bar as shown in fig.
- Join bars A with bar C at a distance 23inch from bar E.
- Join bars A with bar D at a distance 12inch from bar E

Centre bar Design:

Cutting:

S.N	Bar name	Length (inch)	No of pieces
1	I	36.5	2
2	J	9	3
3	K	11.5	1
1 4	H	40.8	1

F. Bending:
- Bend bar H at a distance 14.5inch from left end at right angle.
- Bend bar H at a distance 8.5inch from right end at an angle 45º perpendicular to above direction.
- Bend bar I at a distance 9inch from left end at right angle.
- Bend bar I at a distance 7inch from right end at an angle 45º perpendicular to above direction.

*Welding***:**
- First joint bar I to the bar H at corners of the 45º bend of bar H from both sides.
- Joint all three base of 9inch long to the another end of bar H and I in 90º.
- Joint bar 11inch long in 45º to the bar H at another corner which bended at 90º as shown below.
- Take a bar of length 10.5inch and joint to the bar H at a distance of 5.5inch from curve bend corner to join the support of handle.

➢ *Tyres And Tubes*
Tyres and tubes of required dimension for the rim of 28" and 1.5"

Fig 2:- Tyres and Tubes

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➢ *Mudguards*

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

Fig 3:- Mudguards

➢ *Seat And Backrest*

The whole seat is of fiber for dipping it's weight.

➢ *Accessories*

Following items can be furthermore added as usual accessories:

- Bell/ Horn.
- Red reflectors.

VII. WORKING

- Since it is hand powered tricycle, the power is given by pedaling the sprocket with the help of the hand.
- 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 rear 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.
- Steering the vehicle can be done with the help of the handle of tricycle.

VIII. OBJECTIVES

- Reduce the physical burden on disabled person and be appropriate for use
- Top limit speed to 10 Km/ph
- Total cost of the power train and power supply will not exceed Rs 7000.

IX. CALCULATIONS

Sample Calculation:

Total weight on tricycle = 100 kg

=100*9.81N

= 981 N

Velocity = 36 km/hr.

= 10 m/s

According to Reshton Calculation

Power required = (Weight * Velocity)/ 3.73

= (981 * 10)/ 3.73

= 2.63 kW

For diameter = 28 inch = 0.7112 m

Radius, R = 0.3556

Angular Velocity, $\omega = V/R$

= 10/ 0.3556

= 28.12 rad/s

Torque required, $T = P/\omega$

= (2.63 * 1000) / 28.12

= 93.53 N-m

X. CONCLUSIONS

- A model is designed and fabricated that will be effective in providing mobility for persons who have disabilities.
- One of the major lessons we have learned is that designing an appropriate technology is a huge challenge. Appropriate is more than just availability for replication, it considers longevity, reliability, and efficiency.
- The model which we have fabricated seems to be appropriate considering the results obtained.
- This project provides scope to add advancement in various aspects of working and mechanism for future development.
- It is simple in design and easy to operate. The efforts made for operating tricycle is less this is an advantages of this tricycle.

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