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RESEARCH ARTICLE OPEN ACCESS

Development of Solar Based Tricycle

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Abstract:

We all know that the Tricycle is a widely used vehicle for transportation throughout India. The basic Tricycle is a three-wheeled design, pedaled by disabled persons inthe side and seat in the middle for sitting arrangement. Of all vehicles, hand-powered tricycle are the worst affected by the rough, uneven roads in our country. Most of the people who depend on these tricycles are daily wage workers travel long distances every day. The regular tricycle riders are prone to spinal injuries and huge energy is required to drive which creates a physical burden on the back and moreover many cannot afford good medical care. There are an estimated million tricycle pullers in India alone, with many more in Bangladesh and other developing countries. But tricycles are growing in popularity even in developed countries, with the help of the government. To deal with this problem, we come up with a model tricycle that can be very usefulto people who have a disability in their lower limbs. In order to perform this project, literature review has been made from various sources like journal, books, article and others

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INTRODUCTION

The difficulty in mobility of handicap persons is reduced by emergence of the handicap tricycles. These handicap tricycles can be made more sustainable means of transport by assisting it with some renewable energy resource. Electric vehicle stands its position at the top in alternative mode of transportation. But the cost and availability of the electricity limits its extent to a shorter reach. Thus, the concept of utilizing the solar energy makes its way through this problem [1]. Solar powered handicap tricycle can prove to be more sustainable alternative mode of transportation for the differently abled population.

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To deal with this problem, we come up with a model tricycle that can be very usefulto people who have a disability in their lower limbs. In order to perform this project, literature review has been made from various sources like journal, books, article and others.

Fossil fuels are limited resources which are a primary threat to the auto motive industry and greenhouse gas emissions are one of the major sources of global warming. Electric vehicles are

found to be the key for reducing the emissions and fossil fuel consumption in the automobile sector, but the range anxiety is one of the primary drawbacks of these vehicles. Fossil-fueled transportation is the main type of transportation used all over the world.

This paper provides idea of currently available three-wheelers for disabled people and proposes a new improved design of a solar powered three-wheeler suitable for countries like. This three-wheeler is operated by solar power and suitable for outdoor use. Solar power option enables the disabled people to use it at any place, even in remote areas where there is no electricity.

A general survey had been conducted on disabled people using wheel chairs and manual three-wheelers and the opinions of the experts working with the disabled people are also taken in to consideration to identify the needs and requirement for designing the solar three-wheeler.

The proposed solar three-wheeler is meant to match and exceed the conventional three-wheeler's facilities with a more intelligent and efficient design. A solar panel to produce solar electricity, a battery system for preserving electric power, an efficient motor, cushion seat, all terrain tires are used for this solar three-wheeler. Due consideration and attention is given to better maneuverability, effective use of solar energy, biomechanics and comforts, increased suspensions, all terrain traffic ability, ease of use etc. while designing this solar three-wheeler for physically disabled peopleof the country.

METHODOLOGY

- Finding the problems in existing design of tricycle**.**
- Searching for possible solutions
- Synthesis of the problem
- Selecting optimum solution.
- Executing the design according to the plan of work.

PROBLEM STATEMENT

Tricycle drivers work long hours and many are under-nourished and living in extremely poor conditions. The strength and endurance required for pedaling over rough roads and uneven terrains take a huge physical toll on the drivers, and the community sees frequent outbreaks of disease and other health effects. The Mechanical design of the traditional Tricycles does little to ease the burden on the driver are not the ones purchasing the tricycle, there is little incentive for sellers to improve the design for the better driver comfort and safety.

The existing tricycle has the following problems that can be worked on

1. Large amount of effort is required to drive it.
2. Solar Repetitive Strain Injuries.
3. Vibration Exposure Injuries.
4. Use of conventional Energy Source.
5. Environmental Pollution.
6. High Cost

There are many other problems with the current design such that these tricycles have poor braking, safety lighting, suspension system, and gearing system. The gear ratio for existing tricycles is very high, making it difficult to pedal uphill or start from a standstill. The difficulty in pedaling takes a physical toll on the drivers, who frequently develop joint and other injuries, or outbreaks of disease. The lack of gearing system and high gear ratio on the existing tricycle models make pedaling passengers incredibly difficult for Tricycle drivers. There are many potential solutionsto this problem, ranging from an improved gear ratio to a power assist to aid the driver.

One of the solution to the above problems is developing a solar electric tricycle for handicap person that can give a sustainable alternative for the mobility and travelling of disabled

SYSTEM COMPONENT DETAILS

HANDICAP TRICYCLE

The tricycle for handicap, as available in market is used for the proposed modifications. This existing tricycle is made up of Mild Steel material. The tricycle for handicap person is sometimes manufactured according to the specific requirements of the person. The regular tricycle for handicap is as shown in figure.

The existing tricycle design fulfills the basic requirements of the rider. But due to higher weight, it is difficult for the rider to propel the vehicle smoothly and efficiently. Seating and handling experience have a scope to improve by implementing better quality cushions and ergonomic braking mechanism design.

Fig.1 Regular Tricycle for Handicap

Table 1.Specifications of Regular Handicap Tricycle

Material	Mild Steel
Foot Rest	18 Gauge MS Sheet
Front Wheel	24 X 1 ½
Rear Wheel	28 x 1 ½
Fork	22”
Mudguard	24 Gauge CR Sheet
Chain	112 Link
Overall Length	1800 mm
Overall Width	800 mm
Overall Height	990 mm
Seat Height from Floor and Foot rest	585 mm
Distance between seat and Foot rest	405 mm
Seat Width	500 mm
Armrest Height from Seat	180 mm

SELECTION OF COMPONENTS

Primary selection of components based on the type and working of components is presented in the Table. 5 below.

Further selection process depends on the various factors such as overall weight of vehicle, rider’s weight, torque loads, drag force, wind velocity etc. which affects theof motor power rating, battery capacity, solar panel size and controller configuration.

Table 5. Selection of Components

Components	Types			Selected
Solar Panel (PV)	100watts (1mx1m)	150watts (1.5mx1m)	200watts (2mx1m)	**100watts(1mx.6m)**
Battery	Lead Acid	Sealed Maintenance Free	Lithium Ion	**Sealed Maintenance Free**
Electric Motor	AC Motor	DC Motor	BLDC Hub Motor	**DC Motor Hub Motor (350 watts)**
Controller	24V 12Ah	36V 10Ah	48V 20Ah	**36V 10Ah**

CONCEPT MODEL

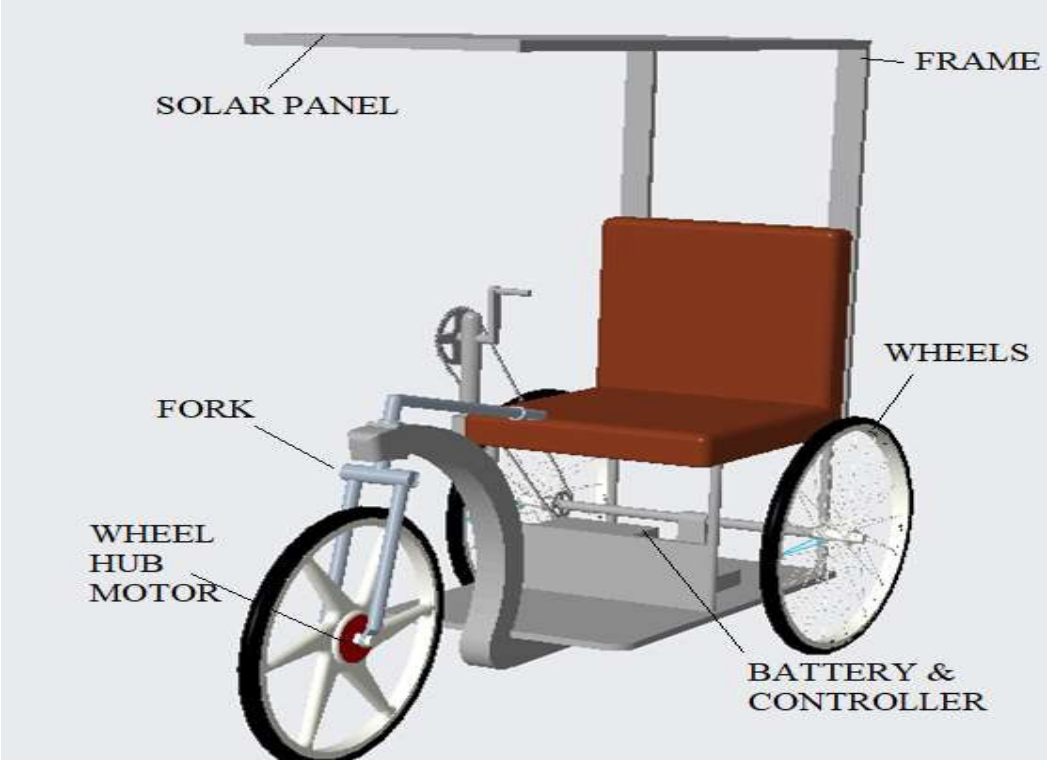

Fig. 14 Concept Model

5.1 COMPONENT DRAWINGS

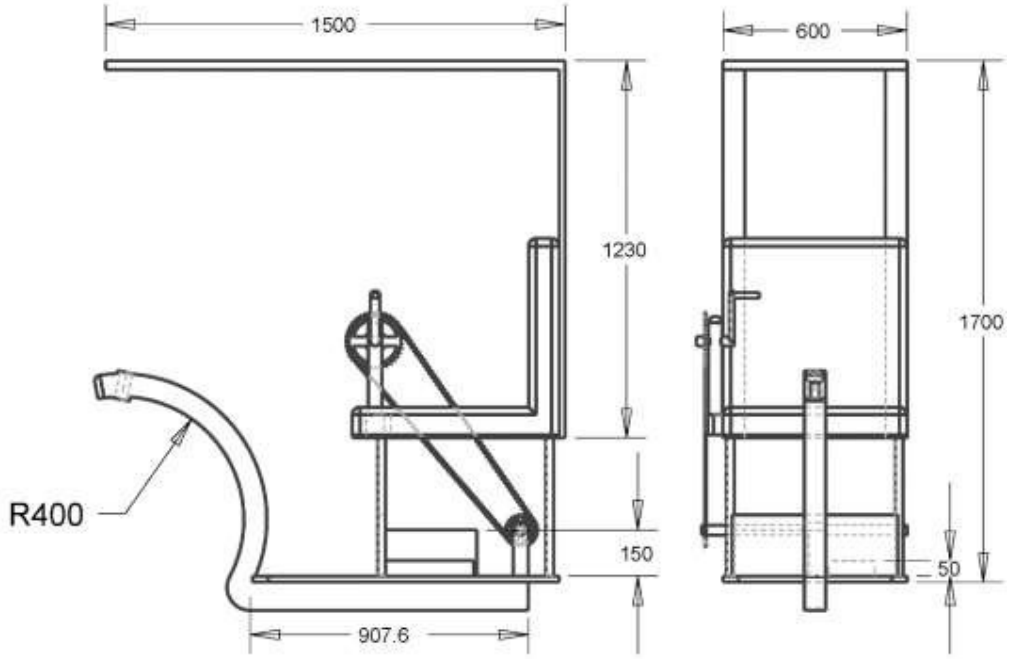

Fig. 15 Frame

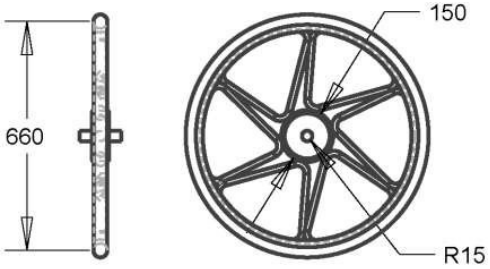

Fig.16 Wheel Hub Motor

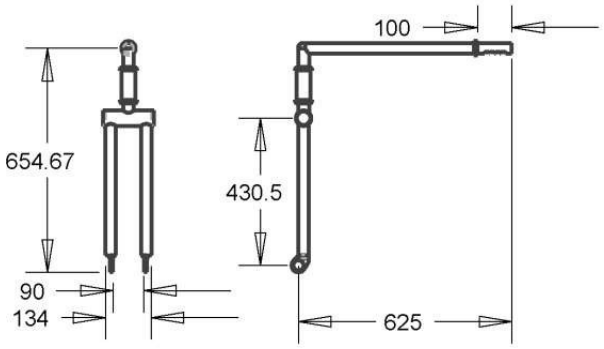

Fig.17 Fork

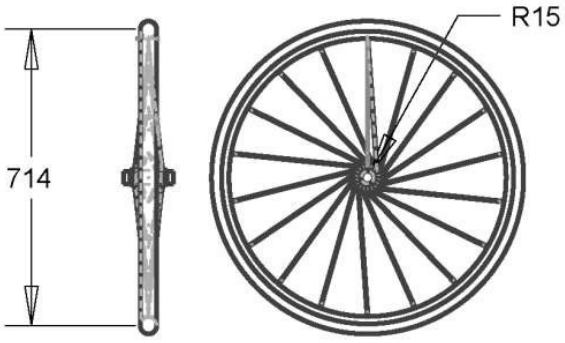

Fig.18 Rear Wheels

CHAPTER 6

CALCULATIONS

Table 6. Weight Estimation

	Weight Estimation	**kg**
1.	Rider Weight	80
2.	Vehicle Weight	20
3.	Battery and Charge Controller	15
4.	Motor	05
5.	Solar Panel	08
6.	Canopy	07
	Total Weight	**140**

Assume the Average Speed of vehicle to be 15km/hr.
i.e. V=4.1666m/s

Total force required to propel the vehicle=
Total vehicle load+ Rolling resistance+ Grade resistance
=140*9.81+ 140*9.8*0.012+ 10*9.81*sin18…(Assume Crr=0.012)
=1814.284N

Torque=Total force required to propel the vehicle*Diameter of shaft
=1814.284*0.015
=27.21Nm

N(rpm)=(Velocity*60) /(2*3.141*Wheel radius)
=(4.166*60) /(2*3.141*0.356)
=111.8 rpm~110 rpm

Power required= 2*3.141*Torque*RPM /(60*Motor Effciency)
=2*3.141*27.21*110 /(60*.9)
=348.311 Watts
Standard motor rating available are 25w, 350w, 500w, 750w
Therefore the optimum chice is 350 Watts motor.

CONCLUSION

Development of the solar three wheeler is a blessing for the disabled people and will have significant change in their mobility as well as lifestyle. Long distance travelling is not possible by this solar three-wheeler due to limited energy storage and it may not perform well during consecutive rainy days. Again the volume/size of the solar panel or solar tracker can be used to extract more energy from the sun to meet up increased energy demand. Sustainable

After going through the research papers, calculations are made and selection of component is done.

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