

Eco friendly zero emission electric tri-cycle

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ABSTRACT: The goal of this electric tricycle is to improve the social and economic conditions of the disabled peoples in India by optimizing the use of renewable energy. In this paper it is discussed how solar powered e tricycle for physically challenged people will help to reduce the efforts of handicapped persons which is operated by a brushless DC motor powered by lead acid batteries which are charged by using a renewable source of energy (solar energy). By using the renewable source of energy we are contributing towards zero emission, reduced equality (SDG10), clean and affordable energy for all (SDG7) committed by the government of India to achieve by 2030 under the UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS. Comfort of a physically challenged person over a long distance travel is an important and we have given importance to it. The main components of this e tricycle includes solar PV panel, charge controller, BLDC hub motor, battery. This paper will discuss the main purpose of the project, problems associated with the present technology, the reason to do this project and problem statement which talks about the problems or weakness of the existing technologies.

I. INTRODUCTION

Eco friendly, zero emission electric vehicles is the need of today's world. Both developed as well as developing countries are focusing on the reduction of the average temperature of the globe which mainly caused by the burning of oils such as petrol, diesel which increases greenhouse gases which in turn increases the temperature of the globe. Electric vehicles uses 100% electric energy but at present especially in India about 75% of the total electric energy is derived from the conventional sources such as coal, petroleum products, natural gas which in turn has two disadvantages,

- 1) Causes pollution.
- 2) Depletes the economically viable conventional sources of energy which takes time to replenish. Sometime conventional resources like coal take even more than 100 years to replenish.

So in order to reduce the pollution and conserve conventional resources not only India but the entire globe is moving towards sustainable development by focusing on renewable and alternative to the conventional sources of energy such as solar, wind, tidal, geothermal etc. being located in tropics and as a founding member of the international solar alliance (ISA) which aims at connects the countries between tropic of cancer and tropic of Capricorn and to make the efficient use of solar energy. India is blessed with lots of solar energy that's why we have decided to make the best use of abundance available solar energy to provide affordable mobility to the physically challenged peoples to improve their living standards. In this project we simply modified the existing tricycle by giving it power train which is easy to use and requires less energy. All essential stress analysis are done by using commercially available 3D modeling software. Through this project an attempt has been made to improve the social condition of the physically challenged peoples, best use of sustainable renewable energy, reduction in pollution and over dependence on conventional energy sources.

Problem identification

Transportation is one of the most important source for increasing mobility of humans. Transportation especially in populated countries like India public transportation plays very crucial role. Normal human being uses this very easily but for a physical challenged person it is very inconvenient, As we can see in the figs below.



Hand operated tricycle Person entering in bus with wheelchair

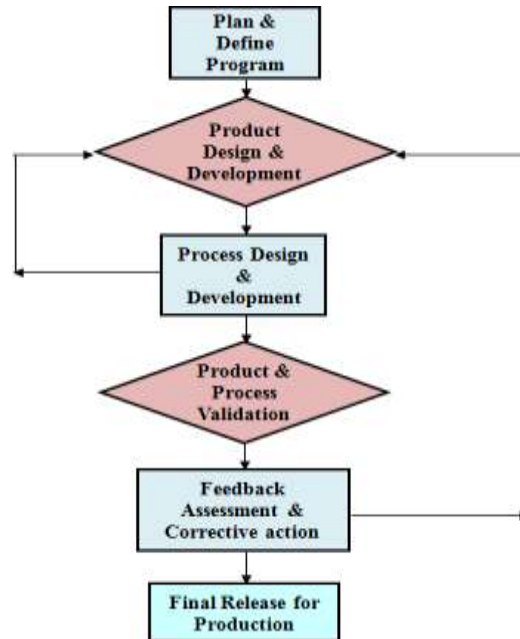


Person entering in train with bamboo stick

II. METHODOLOGY

The solar powered tricycle is designed and modeled with the help of commercially available computer-aided software and analyzed by finite element analysis methods by considering the data we got from the random field survey we carried in order to get basic idea about the requirements of the physically challenged peoples, such as.

1. It should be cost effective.
2. Manual shifting of gear should not be there.
3. Roof provision should be there.
4. It should be easy to operate.
5. It should be stable at the time of climbing the slope.
6. Give proper height to the slope.
7. A physically challenged person should be able to climb up the tricycle without taking help from other person.
8. Functional controls of the vehicle should be within the reach.



Objective:

The proposed Project’s objective is mainly to develop a unique, cost effective, purpose serving motorized solar powered e tricycle for physically challenged peoples. To Design and develop a motorized solar powered e tricycle for a physical challenged peoples for allowing them travel over a long distance without being dependent on the traditional means of transportation.

To overcome the problem and the weakness, this study need to do some research and studying to develop better technology. To make it success, there are several thing that we need to know such as what will be the prime mover, how to stored it and the advantages of this new vehicle.

In that case, these are the list of the objective to be conduct before continue to proceed on this study:

1. Reduced the physical effort to drive the tricycle
2. Top speed limit up to 30km/hr. and average speed up to 20km/hr.

3. To developed tricycle for the longer distance traveling.
4. Cost of tricycle does not exist to Rs. 30000.
5. Improvement in living conditions of physically challenged people.

Theory:

WORKING PRINCIPLE:

How e-tricycle motor works:

Fundamentally speaking, electric motors translate electrical energy into mechanical energy. E- Tricycle use brushless DC motors, or BLDC motors, meaning they don’t use brushes to alternate the direction of current flowing to the motor, as older electric motor did. Those brushes made the motors less efficient and tended to wear out over time, so brushless motors have been the standard for more than a decade. Brushless electric motor use permanent magnets and electromagnets to turn electrical energy into mechanical energy.



Open up a BLDC motor and you will see a bunch of wires wound around a circular series of poles. That's the stator; it becomes an electromagnet when the motor controller draws current from the battery into the wires. You will also see a circular series of permanent magnets, either directly inside or outside the stator. The orientation of the magnets relative to the stator depends on the type of BLDC motor, but either way, that's the rotor. Grasping the interaction between the rotor and the stator is crucial to understanding how e-tricycle motor works. When the current runs through the stator's electromagnets in a circular sequence, those electromagnets repel and attract the permanent magnets on the rotor, causing it to shaft. On a mid-drive motor, the shaft spins to generate torque, and that torque gives you pedaling assistance via a small chain ring connected to the shaft. On hub motors, the shaft becomes the axel and therefore doesn't spin. Instead, the rotor itself spins, causing the entire motor (hub) to spin, thus creating torque to spin the front or rear wheel.

How motor work with the rest of the e-tricycle:



In addition to the motor, all e-bikes have motor controllers and batteries. The controllers modulate the amount of power flowing to the motor, which uses your input to transfer the desired amount of current from the battery into the motor. "What makes an e-bike an e-bike is the experience of how power is being doled out," Lemire-Elmore says. Some e-bikes havethrottles that allow you to use the motor independent of your pedalling although regional laws define where you can and cannot use throttle-equipped e-bikes.

Direct-drive hub motor: Direct-drive hub motors are the simplest e-bike motors. The motor's shaft becomes the rear axle. Because the shaft is fixed in place, the motor (a.k.a. the hub) spins around the shaft, propelling you forward. Direct-drive motors tend to be larger in diameter than geared hub motors, because bigger hubs mean increased leverage and higher torque outputs, which is needed to supply adequate power at lower RPMs. Direct-drive e-bikes can also generate electrical energy during braking in a process called regenerative braking. "Motors are perfectly bidirectional." "They can go forward and backward with equal efficiency."

NEEDSOFETRICYCLE

ADVANTAGES:

1. Solar energy being completely renewable sources of energy creates Zero emission.
2. Provides Seamless service
3. Affordablealternativeoverpetrolbike
4. Easy to drive
5. Cargo carrying stability
6. Improves social conditions of the physical challenged peoples.
7. Less maintenance.

DISADVANTAGES:

1. Initial cost is high.
2. Can't tricycle more than 1 person.
3. Slow speed comparing with other means of transportation over long distance travel.
4. Batteries needs to be replaced after 5-6 years.

Applications:

1. Travel with the power from the sun.
2. Charge while at work.
3. Eco-friendly green transportation over long distance.
4. Simple, low maintenance.

III. RESULTS:

Speed measurement:

By using android application we have tested our tricycle at different places such as metaled road, un-metaled, barren lands with varying speed. Maximum, minimum and average speeds are measured by using this application. For trails we have considered the following three places.

Results of the same are shown below in table,

Sr.No.	Trip	Distance	Time Taken	Average Speed	Maximum Speed
1.		1.5km	3.28min	13.81kmph	20kmph
2.		7km	38min	13.55kmph	20kmph

We have compared our solar tricycle with mopeds running on petrol for physically challenged peoples available in India. Comparison is shown in table below:

Parameter	Solar Tricycle	Moped
Max speed (kmph)	20	20
Pedaling requirement	No	No
Operating cost	Nil	Rs.1.5/km
Weight- Vehicle only (kg)	80	66
Max. traveling distance at a stretch in km	65-70	198
Fuel used per 100km	Nil	1.5L
Charging time (hr.)	3.5-4	NA
Type of energy used	Solar (renewable)	Petrol
Driving noise (dB)	Noiseless	65-70
Driver's license required	No	Yes
Helmet required	No	Yes
Age limit	No	Over 18
Engine size (cc)	NA	69.90

With the above results, our e tricycle provides more benefits to physically challenged peoples. Though the initial cost of e tricycle is high it's a one time investment with little maintenance cost. With the sudden fluctuations in the cost of fuels solar powered e tricycles is proved as a blessing for them.

IV. CONCLUSION.

This tricycle was successfully developed as per the random field survey conducted and requirements of the physically challenged community which works on solar PV cells and employs BLDC motor to drive the tricycle. Various costly remote operated wheelchairs are available in India for physically challenged people but they are very costly and has limited applications and it was concluded that solar powered tricycle proved blessing for a physically challenged peoples. During cloudy/rainy days due to limited solar energy provision is made to charge the battery using external power source.

V. SCOPE OF FUTURE

This project provides scope to add advancement in

various aspects of working and mechanism for future development.

1. Alternator can be used to charge the battery.
2. Gear system can be used to increase the speed of the tricycle.

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