

Design and Fabrication of Physically Challenged Vehicle

(When Both Hands Are Not Functioning)

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INTRODUCTION TO TRICYCLE:

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- 1 A tricycle, often abbreviated to **trike**, is a human-powered (or gravity-powered) three-wheeled vehicle.
- 2 Some tricycles, such as cycle rickshaws (for passenger transport) and freight trikes, are used for commercial purposes, especially in the developing world, particularly Africa and Asia.
- 3 In the West, adult-sized tricycles are used primarily for recreation, shopping, and exercise. Tricycles are favoured by children and senior adults alike for their apparent stability versus a bicycle, however a conventional trike has poor dynamic lateral stability, and the rider must take care when cornering to avoid tipping the trike over.

1.2 Brief History:

A three-wheeled wheelchair was built in 1655 or 1680 by a disabled German man, Stephan Farffler, who wanted to be able to maintain his mobility. Since he was a watch-maker, he was able to create a vehicle that was powered by hand cranks.

- In 1789, two French inventors developed a three-wheeled vehicle, powered by pedals; they called it the tricycle.

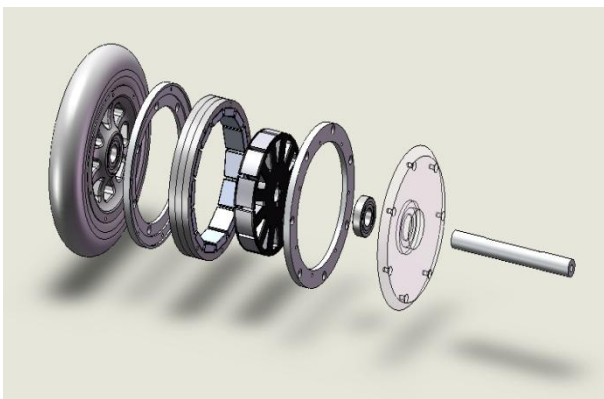
- In 1818, British inventor Denis Johnson patented his approach to designing tricycles.
- In 1876, James Starley developed the Coventry Lever Tricycle, which used two small wheels on the right side and a large drive wheel on the left side; power was supplied by hand levers.
- In 1877, Starley developed a new vehicle he called the Coventry Rotary, which was "one of the first rotary chain drive tricycles." Starley's inventions started a tricycling 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 produced by 20 manufacturers."
- The 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 developed 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. In the UK, upright tricycles are sometimes referred to as "barrows". Many trike enthusiasts in the UK belong to the Tricycle Association, formed in 1929. They participate in day rides, tours, and time trials.



Fig: 1.1 Stephan Farffler's hand-controlled three-wheeled wheelchair

MOTORS



Motor building:

This is brush less hub motor which is used in our vehicle it does not require any transmission chain or belt for transmission of power which reduces transmission losses. The recent trend in the electric bike industry is toward the much more convenient and efficient hub motors, so we will disregard all side mounted motors and discuss further only hub motors. In the following discussion, Therefore, 'motor' means 'hub motor.' For the purposes of this discussion, we will assume that the motor, like all of ours, is built with high precision from quality materials. We will discuss only variances in hub motor design, specifications and working characteristics. Since ultimately the performance of the motor is dependent on a perfectly matched high performance controller we will also assume that, like ours, the motor is controlled

with such a controller. These motors are generally used in electrical vehicles for their higher torque and high load capacity the main purpose for the use of this kind of motor is that it is very high efficient and high performance motor and not very expensive also when compared to all the dc motors used in our day today life .This motor require less voltage and less current electrical losses are very less when compared to other motors.

Brushless hub motor:



Brushless hub motor:

The most common questions we have been asked are: 'How powerful is the motor?' and 'Does the motor recharges the battery?'. The power of the electric motor is certainly related to the power of the electric bike. However the power of the hub electric motor when used for transportation should not be considered in the same way as the power of a gas vehicle motor. The power of the electric bike motor can be a 100% indication how much energy the motor draws from the battery, but may be 60% indication on how powerful is the e-bike itself. The most important feature for electric bikes is the motor torque.

Torque is very important since you carry a restricted amount of energy in your batteries and can't afford to increase the bike performance at the expense of the motor power only (as you can do with the fossil fuel engines). So for optimized e-bike motor efficiency, the motor should have maximum possible torque with the minimum possible power. Greenwit Ltd has introduced Efficiency Index "E_{bk}" which is the ratio of the hub motor torque towards the power of the motor. In other words the higher the "E_{bk}", the better the motor efficiency is.

The most efficient motor should have $E_{bk} > 0.1$. How can we increase the " E_{bk} "? There are two independent ways: by using strong rare earth magnets or by increasing its speed and convert the speed into torque with built in torque converter. The first way, using strong rare earth magnets, is used in 90% of the hub motors. The second way was first used by the Hainzman motors and it is becoming popular for increasing the " E_{bk} " value. Because hub motor torque converters use planetary gears, which are highly efficient, the increase of the torque achieved by this method is tens of times bigger than the losses they introduce.

The integrated gearing inside the motor allows a high torque initial start because the motor starts at its efficient high speed range immediately after the bike throttle is cranked. The integrated gearing also allows the motor to work more efficiently uphill when the speed of the bike is low; the hub motor has conserved its high speed momentum due to its torque converter. Another advantage of the torque converter is that it allows the size and the weight of the regular hub motor to be reduced and increases the torque immensely or the same power consumption.

The other feature of the electric motor that we are continuously asked is if the motor recharges the battery, i.e., 'does it regenerate?' An electric motor 'regenerates' by creating electricity when the motor spins in response to an external force. If there is a load attached to the motor this generation causes a big resistance on the motor shaft. This resistance is a very useful feature of electric bike motors and it is used for electric braking. This regeneration as a power supply for battery recharging is not very efficient and cannot be relied on for recharging the battery.

The regeneration efficiency of an electric bike is 20-40% which means that to fully recharge a discharged battery, one would have to go downhill 3 or 4 times longer than it would take to recharging a battery using a plugged-in charger.

This means that the rider would have to go continuously downhill for 15 - 20 hrs for a full battery recharge. More realistically, if the route your ride your bike on has 20% downhill riding, you will generate enough electricity for 3.3% of the whole battery capacity.

SPECIFICATIONS THE MOTOR:

- This Electric motor is a cost effective mode of personalized transport with its wide range of Electric Two Wheelers. Highly economical compared to petrol two-wheelers and totally environmental friendly as it gives zero tailpipe emissions. It is safe & easy to operate and any one from age group 16-60 with a bit of learning can drive Hero Electric Bikes

BATTERIES:

A battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy...

There are various types of batteries available in the market for choice, namely:



Alkaline batteries and alkaline cells (a battery being a collection of multiple cells) are a type of disposable battery or alkaline batteries. Rechargeable battery dependent upon the reaction between zinc and manganese (IV) oxide (Zn/MnO_2). The alkaline battery gets its name because it has an alkaline electrolyte of potassium hydroxide, as opposed to the acidic electrolyte of the zinc-carbon batteries which are offered in the same nominal voltages and physical size.

- Higher Energy density
- Longer Shelf Life
- Prone to leaking

2. Lead Acid:

Lead Acid is the oldest type of rechargeable battery. Despite having the second lowest energy-to-weight ratio (next to the nickel-iron battery) and a correspondingly low energy-to-volume ratio, their ability to supply high Surge currents means that the cells maintain a relatively large power-to-weight ratio. These features, along with their low cost, make them attractive for use in cars to provide the high current required by automobile starter motors.

Acid

- High Current Surges
- Good Power / Weight ratio
 - Low Energy to Weight
 - Low Cost

3. Nickel Cadmium battery (commonly abbreviated NiCad is a type of rechargeable battery using nickel oxide hydroxide and metallic cadmium



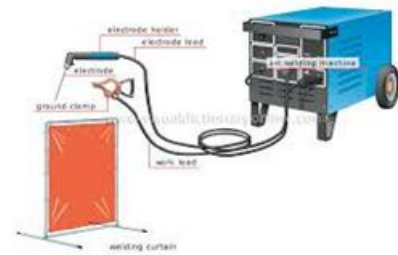
- High Energy Density
- Low self-Discharge
- High cost and Toxic
- Rechargeable
- Overcharging can result in explosion Hydride

WORKING AND PROCESS MADE

1. WELDING:

Arc welding is a type of welding that uses a welding power supply to create an electric arc between an electrode and the base material to melt the metals at the welding point. They can use either direct (DC) or alternating (AC) current, and consumable or non-consumable electrodes. The welding region is usually protected by some type of shielding gas, vapour, or slag. Arc welding processes may be manual, semi-automatic, or fully automated. First developed in the late part of the 19th century, arc welding became commercially important in shipbuilding during the Second World War. Today it remains an important process for the fabrication of steel structures and vehicles.

Electrode Arc welding is used for joining of the MS steel plates. The electrode will act as both electrode and filler material for the fabrication purpose.



2. Welding of the rods:

The rods are welded according to the required area and this is chosen by us because it is the simplest method of designing the base as its low-cost and it's easy to

carry the heavy loads in any situation. All the joints in the vehicle are connected to each other through welding there are less number of bolted joints in the tricycle the welding is done by welding electrode of dia 0.35 mm its code is 6013.

3. WORKING OF MOTOR:

This motor has higher torque and higher E_{bk} than brushed gearless motors. There output is similar to that of the brushed geared motors. For a 250-350W motor, the torque is 18-25Nm. Compared to the brushed motors; there are no parts to contact inside the motor, except its bearings. With fewer parts to wear out, brushless motors therefore last much longer. The most efficient brushless motors have rare earth magnets inside. These motors come as 36V or 48V. Usually 48V are used when more power is required, like in the electric scooters. This lowers the amount of electric current in the controller and alleviates its cooling.

4. Mechanism of 360°:

As the vehicle is running their will be some motion I had arranged a process that I fixed a motor at the one edge of the base in the centre I fixed at a certain height to fix the motor and the motor will be rotate in 360° which is welded to it.

5. Working of acclerator:

As tricycle work with the help of acclerator is a good idea but its working is to dangerous but I took it to a simple procedure for making a basic model so I have used the leg braking for simple working and its procedure is tough of making it but huge loads cannot be applied so we must be careful while driving in rough surfaces. When we apply rotation on the acclerator it automatically applies pressure on the motor and make it to run on the road.

6. MAKING OF JOINT:

As per our availability we used a simple method of working for joints to move upward and downward so I fixed a no end screws and made it to fix at the edge of

bolt with the help of the nuts which make it to work free in motion in any condition and to support the work. I have used the deal wood as a crane work because it helps me to carry high support with low weight in any conditions and also consumes less in energy.

7. MATERIALS USED FOR MAKING:

Cast iron:

All the frame work of the vehicle is done by cast iron it is painted with black colour so that it can with stand all weather conditions and have longer life to the vehicle.

Deal wood:

The wood is the cheap source of material and also the best source of sustaining the load but deal wood is the best source for sustaining the load in other cases than any other of material.

Wire:

I have used the silk wire for the working of the material because it helps to make free accessibility in working.

