

The Electric Bicycle

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Abstract- In this paper, we are concerning about An electric bicycle, also known as an e-bike or booster bike, is a bicycle with an integrated electric motor which can be used for propulsion. There are a great variety of e-bikes available worldwide, from e-bikes that only have a small motor to assist the rider's pedal-power to somewhat more powerful e-bikes which tend closer to moped-style functionality: all, however, retain the ability to be pedalled by the rider and are therefore not electric motorcycles. E-bikes use rechargeable batteries and the lighter varieties can travel up to 25 to 35 km/h while the more high-powered varieties can often do in excess of 40 km/h which motivate us to switch over renewable resource of energy. There are many different ways by which we can save energy in different sectors. Our main focus is on automobile sector where we are converting old petroleum bike to electric bike. In these electric bikes we use electrical motor (BLDC motor) instead of combustion engine as there is less pollution, low maintenance cost, reduces noise. These bikes utilize chemical energy stored in the rechargeable battery packs. This paper deals with the design and development of electric bike which make use of electric energy as primary source. There is a distribution for charging the battery emitting it from the main system.

Keywords- BLDC motor , Bicycle , Controller, Battery

I. INTRODUCTION

The reason make the electric bicycle is to overcome the pollution problem and the economy. Future E bicycle is the best technical application as a solution for the better world and upcoming generation. The E bicycle is a battery operated vehicle that is very economical with low maintenance cost and less pollution. E bicycles are an attractive alternative to both conventional bicycles and traditional automobiles, providing an environmentally friendly, fun, efficient and convenient way to travel. E-bicycle are driven with the help of battery which is coupled with electric motor. E- bicycle is the plug-in electrical vehicles with two or three wheels. The power on which this bicycle works is stored in a rechargeable battery which drives the motor. Now a day's these electric bicycle are manufactured at a very large scale. Typical parts used in E-bicycle are BLDC Motor, battery, controller, throttle, chain set .An Electric Bicycle is a battery operated vehicle that is very economical with low maintenance cost and zero pollution.

Electric two wheelers use the electrical technology of rechargeable battery that converts the electrical energy into mechanical energy. The battery of an EV can be charged easily using a power connection. There are many possible types of electric motorized bicycles with several technologies available, varying in cost and complexity; direct-drive and geared motor units are both used. An electric power-assist system may be added to almost any pedal cycle using chain drive, belt drive, hub motors or friction drive.

II. COMPONENTS OF E-BICYCLE

The E bike consists of following components.

A. BLDC Motor:-

The motor is having rated power of 350w capacity with max 480 rpm, their specifications are as follows:

Rated voltage :- dc 48 v
 Rated speed:- 480rpm
 Rated current :- 9.5 amp
 Protection level :-IP33
 Insulation class:-E



Fig1:-BLDC MOTOR

This motor is BLDC motor to run 48v And the power is 350w speed is 25 to 35 km/h The main characteristic of Brushless DC Machines is that they may be controlled to give wide constant power speed ranges because the Motor Voltage may be held constant at Maximum Bus Voltage over the Constant Power Range. In this condition the machine exhibits a leading power factor and with suitable control leads to low switching losses in the Inverter when in the High Speed Region-The Machine has the lowest size and weight of any of the main contenders.

B. Battery:-



Fig2:-Sealed lead acid Battery

A lead acid battery are the rechargeable battery which is used in many electric vehicles now a days in this battery the lead acid battery moves from the negative electrode to the positive electrode during discharge and back when charging. It is more efficient as it high speed, no pollution, more reliable. Total charge capacity (amp hours), weight, the number of charging cycles before performance degrades, and ability to handle over-voltage charging conditions. The energy costs of operating e-bicycle are small, but there can be considerable battery replacement costs. The lifespan of a battery pack varies depends on the type of usage.in this Electric Bicycle installed 4 sealed lead acid battery of 12 V, 7AH Each.

C. Controller:-



Fig3:-electric bicycle controller

E-bicycle require high initial torque and therefore models that use brushless motors typically have Hall sensor commutation for speed and angle measurement. An electronic controller provides assistance as a function of the sensor inputs, the vehicle speed and the required force. The controllers generally allow input by means of potentiometer or Hall Effect twist grip, closed-loop speed control for precise speed regulation, protection logic for over-voltage, over-current and thermal protection.

D. Electronic Accelerator:-



Fig4:-Electronic Accelerator

Sends electronic signals to the Electronic Motor Controller to the bike.The throttle mode is similar to how a motorcycle or scooter operates. When the throttle is engaged the motor provides power and propels you and the bike forward. A throttle allows you to pedal or just kick back and enjoy a “free” ride.

III. MATHEMATICAL CALCULATIONS

Bicycle data available:-

Notation:-

- d = diameter of the cycle rim in meters.
- r = radius of cycle rim in meters.
- N1=Normal reaction of the road on each tyre in Newton.
- μ =Coefficient of friction = 0.3
- F=Frictional force between tyre and road in Newton.
- T=Torque developed on the shaft due to frictional force in N-m
- t=time required to charge the battery By A- C Supply in hours
- Cycle Rim Diameter d = 56 cm = 0.56 m
- Required Cycle Speed v = 25 km/ph.
- Cycle Weight + Rider Weight w=100 kg

Motor calculations

Since the total cycle weight is equal to 100 kg, The Normal reaction acting on each tyre is equal to (56 x 9.81) Newton each.

Friction force acting on the tyre

$$F = \mu N1$$

$$F = 0.3 \times 549.3$$

$$F = 164.8 \text{ N}$$

Torque required

$$T = F \times r$$

$$T = 164.8 \times 0.28$$

$$T = 46.1 \text{ Nm}$$

Battery specification

Power = Voltage x Current

$$P = V.I$$

$$350 = 48 \times I$$

$$I = 7AH$$

Therefore the time required to charge

the battery completely is:

$$t = AH / A$$

$$t = 7 / 1.7$$

$$t = 4.11 \text{ Hrs.}$$

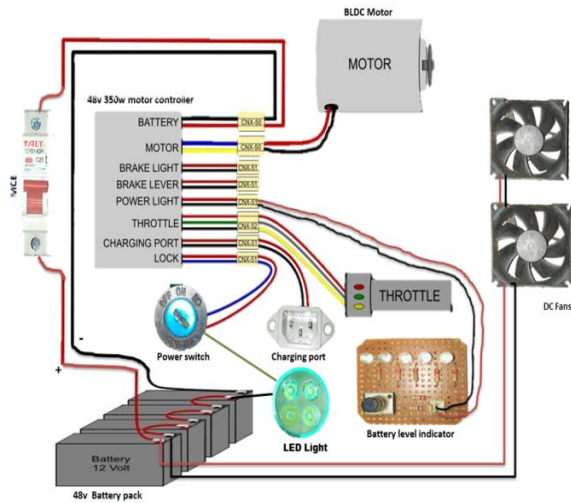


Fig 5:-Block Diagram of Electric Bicycle

Picture of project model:-



IV. CONCLUSIONS

Electric vehicles are the future of our world with the increasing consumption of non renewable resources such as petroleum, diesel which leads us to step our way towards the renewable sources such as solar hydro electric power and

battery. There are alternative ways by which we can save energy. One of such way is electric bike it is also the new way of transport which provides us easy way of transport to provide of any age. It is cheap source of transport and affordable to anyone. The motor used in this bike has high efficiency and the battery bank has less weight with high speed. These bikes are environmental friendly, needs less maintenance and can be also assembled to small component.

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