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DESIGN AND CONSTRUCTION OF AN ELECTRIC BIKE

[1]Vinay Thallapally,[2]T.Madhavi
[12]Associate Professor
Department Of Mechanical Engineering
Sree Chaitanya College of Engineering, Karimnagar

ABSTRACT

The purpose of the electrically assisted electric bicycle is to provide electromagnetic momentums to an already-existing bicycle. This relieves the rider of the burden of producing the energy required for the bicycle to operate as intended. Its strong motor and ample battery capacity allow it to aid with hill climbing, provide faster driving speeds, and offer completely free electric transportation—all it has to do is be charged. Reducing the amount of fuel used and the environmentally hazardous results of its burning is our responsibility. All things considered, it is a small step towards reducing the use of fuel-intensive automobiles and bringing attention to alternatives, such electric bikes, to these forms of transportation. Thus, we suggest building a bike that runs on batteries rather than electricity. We call this kind of bike "battery-operated." A human rider would need to put forth less effort with this bike.

Among the terms to search for include electric bike, fabrication, and battery.

1. INTRODUCTION

In transportation we have developed quite a lot by the range of hi-tech vehicles we have, still the importance of bicycle cannot be neglected. Bicycle is popular in all groups because it is easy to handle by its light weight, and do not cost money to operate as it does not require fuel to run, still very efficient in small distant traveling. It has many distinct qualities, which make it even special over other vehicles, like they do not require registration fees, insurance, or driving license. Similarly, it has less prone to heavy casualties, thereby making it a safer transportation. Besides, it has health benefits, just the same way as in any physical exercises.

Like this, e-bike on the other hand is a modified version of the same. In e-bikes the difference comes by the application of the motor system, use of the controller to control the motor system, and with battery to Power it. The motor is used to give external power to make the ride comfortable. E-bike is better than the normal bike because rider can get additional power when it is required, if it is used like that. In this the rider has the choice when he is less of power and unable to drive forward easily, usually when there appears an uphill or strenuous long road, he can switch on the battery, and thereby activates the motor. Then motor compensates the required power and this way ride becomes smoother all the way. It is up to the rider as when he wants to switch on the power. He can choose motor to propel all the way for his support or use it when he needs. There are again various levels which the rider can choose depending upon the condition of the road, and the amount of speed that is desired in riding.

Future of e-bikes

The advantage of e-bikes has become more prominent in the recent times. The big companies' involvement helped to make it even better. They have tried to include many sophisticated technologies in the design of this e-bike. Brushless motors replaced the brushed ones to make it durable, efficient, and noise-free ride. Lithium battery inclusion has made e-bikes much lighter with better performance. Throttle replaced with Torque sensors has made the ride smoother. That is why today e-bike is growing popularity because of having the characteristics like lightweight, good-looking, and able to make a long ride up to 55 miles on a single charge. E-bikes are now the rapidly growing name in the bicycle industry. Now with the demand for clean and safer world, there is only one possibility remains, success and just only success.

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2. LITERATURE REVIEW

The German Naturalistic Cycling Study – Comparing cycling speed of riders of different ebikes and conventional bicycles [1] Objective of this paper to was to explore the acceleration and speed of orthodox and electrically powered bicycles under truthful statuses. Authors distinguished between electric bicycles which deliver provision up to 45 km/h (as known as S-pedelecs) and 25 km/h (speed of pedelecs). Additionally, as speed limits of 30 km/h might influence especially on the execution of speedier cyclists (e.g. Spedelec rider), the potential mean speed might be even advanced under various situations. Authors also found noteworthy variances in numerous measures between pedelecs and orthodox bicycles, although less noticeable.

Urban Electric Bike [2] In this paper, authors considered importance of easy vehicle mobility and compactness. In which they revealed that folding is the strategic feature of the e-bike which would not have been probable devoid of the folding arms. For the ease of sliding of the arms a bolt is provided. To provide rigidity to the bike a guide has been provided on the main frame. About other components, both the plates are welded on front arm of the bike and a constraint is established on the back arm to confine the angle between the two arms to 50°. Furthermore, in paper the specifications and functionalities regarding components of e-bike were discussed

Campus Mobility for The Future: The Electric Bicycle [3] this paper presents the various outcomes and results of the study containing visions into the scheme. Electric bikes, of much sort have been surveyed by and by in a semi-open contract conspire on the Nanyang Technological University campus in Singapore. According to this campus, it is a famous and helpful administration, with a few models of electric bike being exceptionally very much utilized. Riders contemplate the premier of the electric bikes to be both agreeable and engaging while at the same time utilizing it, and extremely suitable for campus travel.

Advantages

- Easy to commute with low fatigue.
- Less maintenance cost.
- Normal Drag/Pedal is possible when power is not in use.
- Deployable batteries – can be taken inside house.
- Cost of the unit is exceptionally low.
- Easy to carry since it is portable.
- Less energy consumed.
- High efficiency can be obtained if inverter is used.
- If using solar panel, free utilization of energy can be done.

Disadvantages

- High intensity of wind load.
- High centre of gravity.
- Cannot tolerate drastic changes in environment.
- Needs Periodic Monitoring.

3. CALCULATIONS

3.1. Load Speed Calculation

Step 1:

Number of teeth on smaller sprocket (motor) (t1) = 9
Number of teeth on larger sprocket (bike) (t2) = 18
Speed on smaller sprocket (motor) (N1) = 3300 rpm
By using reduction ratio (9.78), speed will be reduced to 338 rpm
Speed on larger sprocket (bike) (N2) = ?

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Step 2:

Using speed ratio formulae,

N1t1 = N2t2

N2 = 169 rpm

Step 3:

Diameter of wheel =650mm

Circumference of wheel =3.14*650=2041mm

Step 4:

Speed of vehicle = speed of wheel X circumference of Wheel

=169 X 2041=344418075 mm/min=344.41 m/min =20665 m/hr =20.66 Km/hr

3.2. Required Power to Drive Bicycle

Step (1)

Total load act on bike is as follow

Normal weight of person =60 kg =60*9.81 =588.6 N

Weight of bicycle = 100 kg =100*9.81 =981 N

Other Miscellaneous load =5 Kg =5*9.81 = 49.05 N

The total load = (588.6+981+49.04) = 1618.64 N

Step (2)

To find reaction on each wheel, The above total load

which is divided equally on both wheel

Force (Ffw) =Force(Frw) =681/2 =340.5N

Where reaction on rear and front wheel are as follows

Rfw=Rrw =0.2*340.5=68.1 N

Step (3)

To find torque on each wheel

Total torque=Tfw+Trw

To find Torque on Front Wheel

T1 = Rfw*(D÷2) =68.1*[(65*10-2)/2] =22.1325Nm

T1=T2=22.1325Nm

Total torque on wheel=44.265 Nm

Step(4)

To find power on motor = 391.69 watt

3.3. Working

The working of our project basically explains by using the five blocks as follows:

a) Battery.

b) Motor Controller Circuitry.

c) Electric motor.

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d) Chain and Sprocket.

e) Controller.

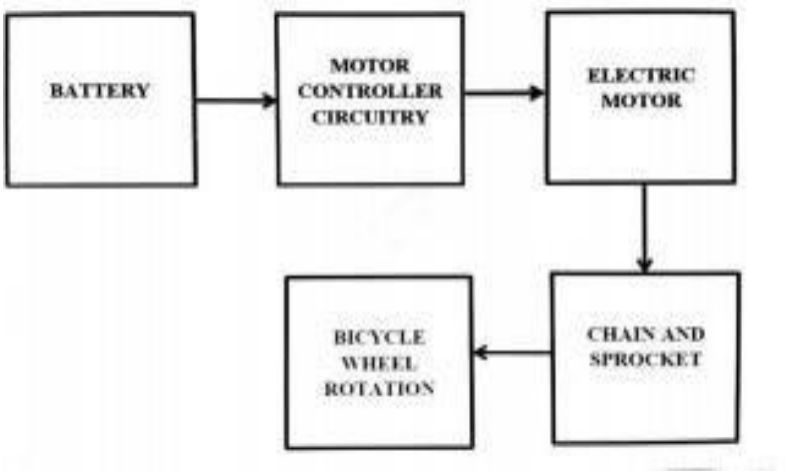

Fig. 1: working of E-bike

4. CONCLUSION

With the evolution of the present E-bike model and the numerous experiment results gained by different authors, the goal of a pleasant, compact, high-speed, and efficient bicycle may be reached. This development incorporates previously known findings from literature on topics like aerodynamic design and frame tube material selection.

Bicycle's no-load speed calculation is = 50 km/h. 591.69 watts of electricity are needed.

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