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Two Fold E-Bicycle Using PMDC motor

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ABSTRACT: Now a days, with the growing quantity of automobiles the need for petroleum products is reaching the peak point. These petroleum products are non-renewable sources and it has a danger of exhaustion in future, so it is better to move to an alternate energy like electrical energy. During the revolution for the eco-friendly technologies bike were the most depended modes of transportation along with this the consideration of the increase in the fuel price an environmental factors we must admit that it is for the more advantages. As we are using fuel combustion engines in all automobiles, which releases massive quantity of greenhouse gases like CO_2, CO…etc. results in global warming. Diesel and petrol vehicles ought to be replaced by their respective necessitiessuch as tricycle for auto-rickshaw, tram cars for buses etc. The primary goal behind handling this project is it becomes very important to fabricate the electrical bike so affordably so that the common people in our country can afford to buy it and to use a bike over a motor vehicle for traveling. Along the development of technologies the theory must be additionallyapplied to design and manufacture a product that can be sold off at greater frequency which has a low production cost and with a very good quality.

KEYWORDS: PMDC motor, electric battery, batterycharger, foldable e-bike, motor controller, folding mechanism

I. INTRODUCTION

In today's date modern world needs the high technology which could clear up the current and future troubles. Primary reason to identify the need of locating and enhancing E-bike is to overcome the problem of pollution because of automobiles in metro towns and city zones is developing uninterruptedly. By considering this we have designed "REGENERATIVE BIKE" Which works on electrical energy & produces electrical energy. Hence we can save energy and reduce pollution also.

Typical parts of E-Bike are PMDC motor, throttle,battery,frame, charge controller and other common bicycle parts. This project deals with the principle of conversion of electrical energyinto mechanical energy by PMDC motor. The speed of PMDC motor will be controlled by PWM technique which varies the average dc voltage applied to the motor.The motor is activated with the aid of throttle with energy on demand equal as in trendy scooter or bike. This e-bicycle can also be folded in two parts and can be made as compact bicycle to carry. This bike can drive electrically.

 This bike is eco-friendly such that it does not lead to any pollution also it is light in weight and more reliable and cost effective. It does not produce any flue gases during operation. This bike is also installed with folding mechanism First fold is at the center axis of the bike and second is at the handle bar .This main feature makes the bike compact and easy for carrying during travelling . The combination of electrical energy and human force make this bicycle unique and feasible.

II.   METHODOLOGY

The proposed methodology involves the usage of Throttle assist technique by using a PMDC motor at the Rear wheel. On a usual working, the rider needs to pedal the e-bike & needs to move ahead with the travel. A 24 V battery (which has been already charged) before the beginning of travel, serves as the source of electric power to the PMDC motor already installed in the e-bikevia charge controller.
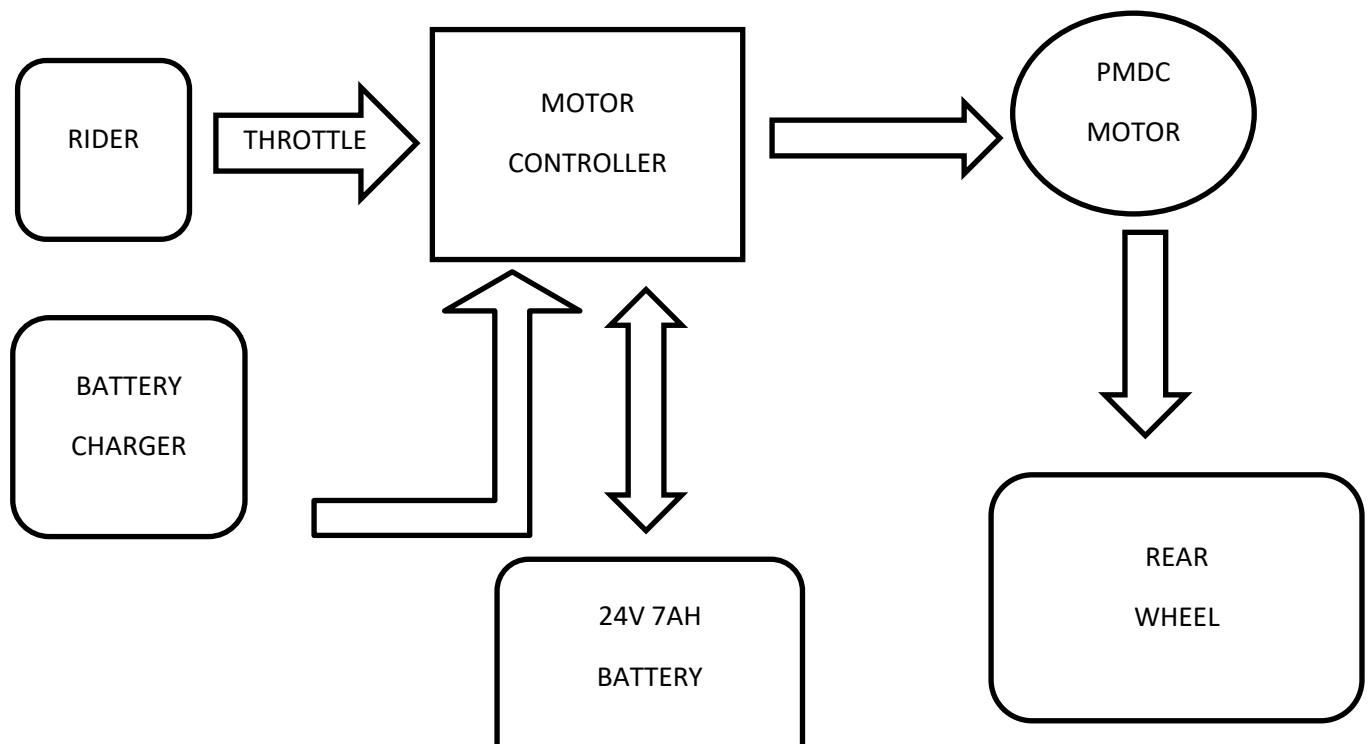

FIGURE1: FLOWCHART OF WORKING OF E-BIKE

 The charge controller serves two purposes. Firstly, it will prevent the batteries from getting overcharged & secondly it helps in regulating the flow of electric power take out from the batteries. Thus, charge controller helps in preventing the batteries from over charging & over draining. The gears installed in the wheels work as simple machine regulating the speed & torque also facilitates the translational motion. The important aspect for an e-bike is to provide the rider with smooth speed control. For this, the installed Electronic Throttle Control is of prime importance. The throttle valves are opened & closed through the PMDC motor which in turn provides an added speed which helps the rider to get a boost with the actual moving velocity. The throttle control helps in increase & decrease in the actual velocity of the e-bike which smoothes the e-bike ride. The efforts of the rider are minimal & the travelling is made easy with the smooth controlled speed. The installed hinges (with supporting nut bolts) at the middle part of the e-bike helps the rider to fold the e-bike, so the rear & front wheel are on the same direction. The hinge installed at the handle bars helps in bending & providing a comfortable lift of the entire e-bike. The bending of the handle bar provides proper holding of the bike.

Problem Identification:
The Electronic Bicycle provides the customer with pedal-assist, less pollution &eco-friendly solution over the existing conventional Bicycle which involves a lot of manual effort & sweat rides. The existing Electronic Bicycle are costly, low load carriers, limited-speed & difficult to carry with. Apart from the defined models & modes of usage the e-bikes

still remains to be a costly affair for the average customer & it is difficult to carry them from place to place & mostly making the customers move to the conventional fuel based mode of public transportations.

Solution:

The provision of inclusion of hinges at the handle bar & the middle part of the bicycle facilitates to have the e-bicycle folded & makes it easier to carry the e-bike from place to place. The usage of PMDC motor with electronic throttle provides an easier gear shifting &torque management system for the rider, in addition the usage of Charge controller facilitates to regulate the use of the electric power from batteries also preventing them from getting overcharged. Thus, the overall design helps the rider to have a smooth controllable, pedal-assisted, torque managed, light weight, foldable & easily transportable Electronic Bicycle.

III. ANALYSIS

The proposed the Electronic Bicycle provides a maximum speed of 32 Km/h & a travel range of approx. 80 Km on fully charged battery. With a fully charged battery the power consumption is approx. ~ 500Wh.

The charge controller provides the battery charging in 2-8 hours & there is 400 cycles of charge/discharge. The proposed e-bike provides a smooth control with the above mentioned features which makes it a low cost, eco-friendly, easily transportable machine.

II. MATHAMATICAL CALCULATION AND RESULTS

NO LOAD SPEED CALCULATION

Step 1:-

Number of teeth on smaller sprocket (motor) (t1) = 9

Number of teeth on larger sprocket (bicycle) (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 (bicycle) (N2) =?

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.

REQUIRED POWER TO DRIVE BICYCLE

Step (1)

Total load act on bicycle is as follow

Normal weight of person =65 kg

=65*9.81=637.65N

Weight of bicycle = 5 kg

= 5*9.81= 49.N

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

The total load = (637.65+49+49.04) = 735.65N

Step (2)

To find reaction on each wheel, the above total load

Which is divided equally on both wheel

Force (Ffw) =Force (Frw)=735./2=367.8N

Where reaction on rear and front wheel are as follows

Rfw=Rrw

=0.2*340.5=73.56 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

Our model has foldable handle bar and slide able body so that the complete body of motorcycle may be brought into compact shape, for this reason this motorcycle may be placed in the boot area of any automobile and different vehicle. Even the weight of vehicle ismuch lessconsequently it is able to be carried without difficulty from one place to another.

- • Average speed 12 mi/h 19 km/h
- • Maximum speed** 20 mi/h 32 km/h
- • Travel range 10–50 mi 16–80 km (Full charge)
- • Batteries Charging time 2–8h
- • Cycles of charge/discharge Up to 400
- • Power Power consumption 100–500 Wh (Each full charge)
- • On-board power supply 12–36 V
- • Torque Hill climbing ability up to 6% slope Weight Electric bicycle kit 10–50 lbs. 4.6–22.8 kg
- • The calculated No load speed of bicycle is =20.66Km/hr.
- • The Required power is =391.69 watt

III.   CONCLUSION AND FUTURE SCOPE

With the aid of the use of mechanical and electrical knowledge a regular bicycle turned into transform two fold electric powered bicycle that's a new revolution in the field of electric vehicles. Due to exponential increment of population, foldable electric motorcycles will be end up more convenient mode of shipping. On this electric mobility era the need of foldable e-bike is growing exponentially. Various challenges which were faced during the project making process increased depth of knowledge in electrical and mechanical field.

IV.FUTURE SCOPE

1. Mechanical modifications –can be modified into four fold mechanism

2. Electrical modifications –

a) Motor – In project PMDC motor has been used instead we can replace ir with hub motor which   increases efficiency by 30%

b) Battery – In project led-acid battery has been used instead it can be replaced with lithium ion battery which

Will increase its range by 10 km

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