Hybrid Powered Electric Bycycle Using Solar & Dynamo

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A**bstract: The hybrid powered electrical bicycle is a system that involves three different ways of charging a battery: Solar power, Dynamo and 240V ac charge. The power from these three modes is used to charge a battery with an electric motor running a bicycle. The hybrid powered bicycle is designed in such a way that the rider can have to modes of operating bicycle that can choose the bicycle to be driven completely with the electric motor or it can be driven manually.**

Index Terms: Bicycle, Controller, Electric Motor, Throttle, Solar panel, Dynamo

I. INTRODUCTION- The electric bicycle offers a cleaner alternative to travel short-to-moderate distances rather than driving a gasoline-powered car. The price of crude oil has increased significantly over the past few years and there seems to be no turning back. The environment has also been more of a focus throughout the world in the past few years, and it seems that cleaner alternatives have been steadily on the rise with no end in sight. The electric bicycle is a project that can promote both cleaner technology as well as a lesser dependence on oil. It will run on clean electric power with the ability to recharge the battery 3 separate ways: through the 120 VAC wall source, by generating power through the pedals of the bicycle, and by solar-cell generative power. An extra benefit to building the electric bicycle is that it can also show the general public how much cheaper it would be to convert their regular bicycle into an electric bicycle rather than driving solely in their gas-powered vehicles. The greater importance of the environment in the world leads to an opportunity for students in our position. With the economy trying to get out of one of the worst depressions of the century, there are numerous opportunities for us to help out. This is our opportunity to contribute a greener and more efficient planet.

2. OBJECTIVES

These are the objective to be performed before continuing to proceed with this project.

- To reduce the pollution.
- To reduce the dependency on fossil fuel
- Easy utilization of renewable energy Sources.
- Environmentally Eco friendly and cheap.
- The battery and, we use dynamo to charge the battery when the bicycle is in motion.
- When there is no sunlight the battery provides for recharging using the wall charger by plugging into ordinary wall outlets, usually taking about three hours to recharge.
- The battery gives the required voltage to the hub motor mounted on the front wheel to run the bicycle.

3. CALCULATIONS

Volt = 36 V

Power = 250 W

3.1 *POWER EQUATION*

Power = *I* * *V*

Where

V = 24 V

P = 250 W

I = 250/24

= 10.4166 A

3.2 *TO FIND TORQUE OF THE MOTOR*

T = P*60 / 2*3.14*N

= 250*60 / 2*3.14*300

= 7.96 N-m

Torque of the wheel hub motor, T= 7.96 N-m

***3.3** POWER REQUIRED TO PROPEL THE VEHICLE*

Weight = 72+(70*2) =212 Kgf

Total resistance = Rolling resistance + Air resistance + Gradient resistance

$R=K_rW+K_aAV^2+W\sin\theta$ $R=(0.018*212)+(.0028*30^2*.635*.9)$

R = 51.56N

Power = (51.56*8.33)/0.9

= 2277.417

Hence, the power required to propel the vehicle is 477.417 W, which is just below our motorspecification 500 W and the design is safe

4. METHODOLOGY

An attempt is made in the fabrication of a solar and dynamo powered hybrid bicycle System for a two-wheeler. There are so many vehicles that cameto influence in the existing world. Their operating systems are based on the usual fossil fuel system. At the present sense the fossil fuel can exceed only for a certain period after that we have to go for a change to other methods. Thus, we have tried to design and fabricate solar bicycle, which wouldproduce the cheaper & effective result than the existing system. This concerns with different parameters like

5. DESIGN PARAMETERS

The design involves the calculation of driving torque and power requirement to ride the bicycle, rating of motor, selection of motor, battery, capacity, dynamo and solar panel.

5.1 DESIGN OF SOLAR AND DYNAMO POWER DRIVEN BICYCLE

Problem statement

Diameter Of wheel D = 0.45 MeterSpeed V = 10 KM/H Weight of Bicycle W_1 = 40 Kg

Weight of Rider W_2 = 60 Kg

Total weight. W = 100 Kg

SOLAR PANEL: In this the main component is PV cell. PV cell is a component which makes use of the sunlight in order to generate electricity. The reason for this use is mainly that it's a renewable energy source and can be obtained as long as possible.But the main drawback is that it's not a continuous process. That means that under unfair conditions or in the night timeit's not able to generate electricity. Hence an alternate should to ready if it's for a long distance or so.

When the sun rays fall on the PV cell due to the photons the electrons or holes gets displaced, that is the motion of charges depending on the type of the materials used to dope. This displacement of electrons causes the electricity. This current mainly depends on the temperature. As temperature varies current varies. This is as given in the equation.

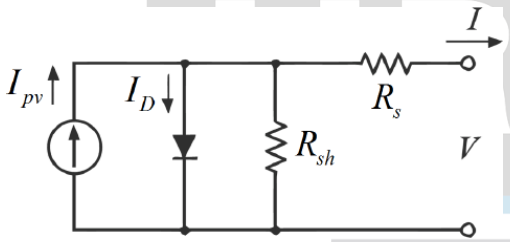

Fig:1 equivalent circuit of PV cell.

I=Iph-Is(exp(q*(V+RsI)/NKT)-1)-(V+RsI)/Rsheq(1).

Where I=output current in amps

Iph=photo current due to incident of light and is a function of temperature.

q= charge in coulombs; 1.6e-19

K= Boltzmann constant; 1.38e-23

V= cell output voltage

Rs= series resistance in ohms

Rsh= shunt resistance in ohms

T= temperature in kelvins

The output of this PV cell is in dc form. Hence it can be stored and can be used when required.

The charging is controlled using charge controller and its output is given to the lithium ion battery. Hence the selectionof type of

lithium ion battery becomes the main criteria.

Fig:2 Solar Panel.

BATTERY:

This battery size is of a brick block and can be placed underneath the passenger compartment. As the output of the battery is a dc and should be converted to ac before it reaches the motor side as it's the one which produce propulsion. The inverter is as shown below.

Fig:3 Li-Ion Battery.

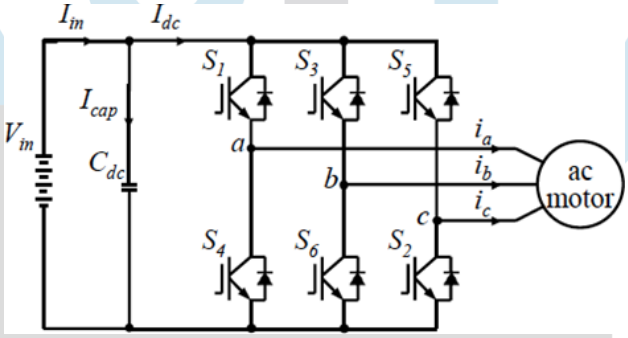

Fig:4 circuit of an inverter.

Each section produces an alternating source. The output of all the side becomes a 3-phase and can be connected to the motor for further use.

Panel selection

We use two panels of 20 W each having dimension200mm* 160 mm to develop a voltage of 336 V Time require to charge the Battery two panel 20 Watt each 20*2 = 40 Watt.

48*7/40 =8.4 Hours.

Dynamo selection

We have selected 48 Volt Motor, so we selected 24V 50 W dynamos.

Time required to charge the battery t_3 =48*7/100 =3.36 hours.

5.2 FABRICATION PROCEDURE

In this project we selected the required components depending upon the calculated rating values using the standard formulae. We have selected 48 Volt hub motor, four batteries of 12 Volt each are connected in series, two dynamos of 24 Volt, two solar panels of 12 Volt, Electronic control module, Full twist accelerator throttle,

Fig:5 Fabricated model Solar and Dynamo operated hybrid Bicycle

5.3 SIMULATION

Since the PV cell is the main part as it's the one which generates main energy when there's no fuel to start. Hence, we shall simulate the PV cell in the first place. PV cell is implemented in the MATLAB software. The entire solar array is compressed in a subsystem. Inside the subsystem the respectiveequation's implementation is done inside.

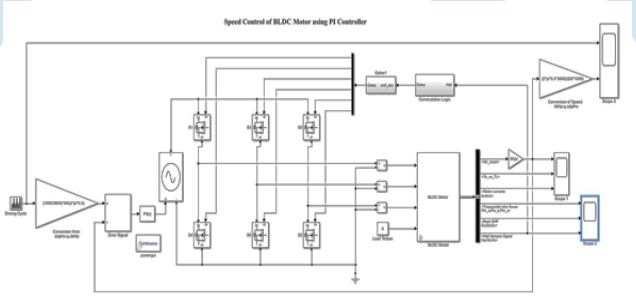

Fig:6 Fabricated model Solar and Dynamo operated hybrid Bicycle

5.4 RESULTS

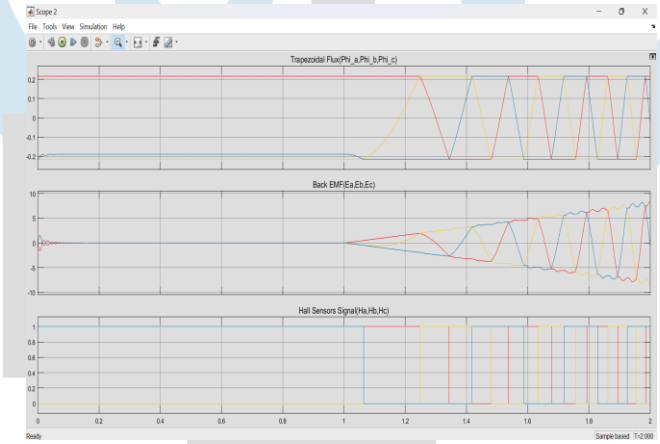

Fig:7 Simulation of Back EMF

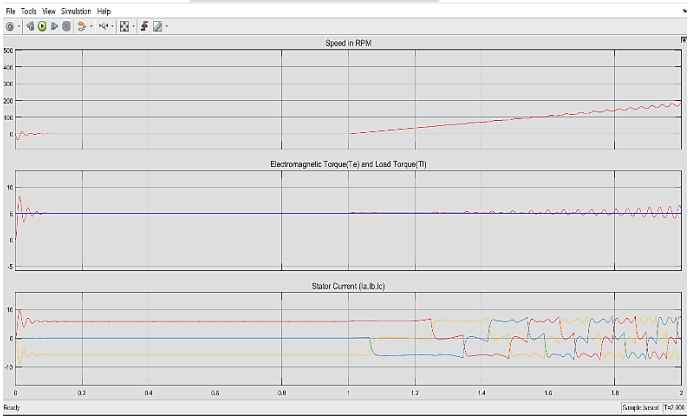

Fig:8 Simulation of speed in RPM

CONCLUSION

From the above all sections, simulations, and mainly the future availability of the resources we can conclude that by some other modifications we can obtain even better efficiency as well as the maximum power.

PV cells: from the simulations what we have obtained shows that the maximum power obtained can be of nearly 25W. This is for single cell and when calculated for the entire panel reaches for 900W.

Lithium ion battery: This from the inspiration of Subaru company product as it possesses certain attractive features we hadtaken this battery.

Dynamo: This has added an extra power by taking the rotational energy into account. Thereby increasing the efficiencyof the car with respect to the mileage.

Though the cost is a bit high, keeping in the mind of future problems as well as the ecological problem we need to compromise with it.

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