Solar Assisted Electric Bicycle with Variable Torque Drive System

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Abstract— This project contains the design, construction and implementation of an efficient solar assisted electric bicycle at low cost. The solar assisted electric bicycle is implemented using a PMDC motor and controller with the help of solar panels and battery.The focus of this report is to perform energy calculations and system design on solar powered E-bicycle.

Key words: Electric Bicycle, Torque Drive System

I. INTRODUCTION

In the current scenario, the major problems are global warming and lack of traditional resources. Due to these facts the purchase of electric bicycle is increasing not only in India but also around the world. Important feature of this bicycle is that it does not consume fossil fuels thereby saving crores of rupees. It is pollution free & ecofriendly as it does not have any emissions. In face of continuous climate discussions and permanent traffic jams, electric bicycles have the potential of solving such issues and making a more energy efficient and environment friendly mobility possible.. Irrespective of the all benefits it includes health benefit also.

Fig. 1: AVAST 250p

II. WORKING OF ELECTRIC BICYCLE

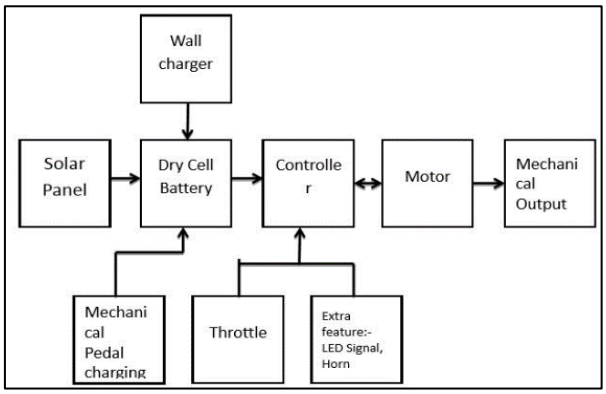

Fig. 1: Block diagram for Solar Assisted Electric Bicycle with Variable Torque Drive System

The main components of this project arePMDC motor, motor controller, lead acid battery and solar panel. Also solar throttle and extra features such as horn and, LED signal etc. are shown in this diagram. The power source for this system is given by lead acid battery. The output of lead acid battery is 24V. The battery is charged with photovoltaic solar panel and it is light weight. The output of solar panel is 12V and 20 watt. Voltage and current is generated through the solar panel is supplied to battery source.

A PMDC motor works on the principal of electromagnetic induction which helps to generate necessary torque required for the motion of the bicycle.It is an internally commutated electric motor designed to be run from DC power source. PMDC motors can be varied in speed by the strength of the magnetic field or by changing the operating voltage.

The power of electric motor is fed to the motor gear mechanism through a controller.The controller is used to control the power to the motor. It also has a power lock which is connected to a key lock system. The electric power is fed to the controller only when the key is turned on just like an ignition system in a motor cycle.

The bicycle gets electric energy required for its operation from the batteries which are assembled inside. The batteries are charged with the help of a 24v charger. The charger is made of a transformer which steps down 230v to 24v. The 24v AC voltage is then converted into 24v DC with the help of rectifier circuit.

When the throttle is raised the motor gets increasing current input and the speed of the motor increases.

Alternatively, our E-bicycle can also be charged by solar energy with the help of solar panels fitted on the back side of the E-bicycle. The motor is connected to the gear drive system through a chain mechanism. The motor rotates gear, we can shift gears to increase speed with the gear shifter provided on handles of the bicycle.

When the shaft of the motor rotates it drives the gear assembly of the wheels which in turns generated required torque to move the bicycle.After that we can manually shift the gears to achieve maximum speed.

III. CALCULATING MECHANICAL POWER REQUIREMENTS

Calculation for range of bicycle:

Capacity of battery	=24V*7Ah
	=168 Whr
Maximum wattage of motor	= 24V*13A
	=312 Watt
Range of bicycle in hr.	=168/312
	= 1/2 hrs.
Range at full speed	=30*0.53
	=15.9 Km
Diameter of Wheel	= 66cm

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Perimeter of Wheel =66*3.14
=2.07 m
Calculation for maximum speed =245*2.07*60
=30.429 km/hr
Maximum Torque = 22 Nm*3
=66 N-m

IV. PERFORMANCE RANGE OF COMMERCIALLY AVAILABLE BICYCLE

Average speed	19km/hr
Maximum speed	35km/hr
Travel range(full charge)	16-80km
Battery Charging time Cycles of charge /discharge	2-6 hr Up to 400
Power consumption(each full charge)	100-500wh
On board power supply	12-36 volt
Weight	20 kg

Table 1: Performance range of commercially available bicycle

V. RESULT

Parameters	Solar assisted bicycle	Moped	Ordinary bicycle
Max. Speed Limit(km/hr)	25-30	45-50	10-15
Drivers Pedaling Requirement	No	No	Yes
Initial Unit Cost	16470	35000	3000
Operating cost for 40 km travelling in Rs.	Nil	45	Nil
Weight	40 kg	80 kg	15 kg
Max. travelling distance at stretch in km	35-40	150	15-20
Fuel used per 100 km	Nil	2 L	Nil
Type of energy used	Solar	Petrol	muscular power
Driving noise(db)	Noiseless	70-75	Noiseless
Driver's license required	No	Yes	No
Helmet required	No	Yes	No
Engine size	Not applicable	100-125cc	Not applicable
Age limit	No	Yes, over 18	No

Table 2: Comparison between solar assisted & ordinary bicycle

VI. CONCLUSION

From a future energy system perspective, it is important to identify new ways of transport and generation of electricity and solar powered E-bike pools may just be such a case. E-bikes are an order of magnitude more energy efficient than car, bus or other heavy transport mode. In this project we have implemented solar assisted electric bicycle using a PMDC motor and controller with the help of solar panels and battery. We have worked on system design and performed power and speed calculation on solar assisted electric bicycle successfully. It is suitable for both city and country roads. This bicycle is simple to construct, cheaper & can be widely used for short distance travelling.

So we have constructed solar assisted bicycle which is modification of existing bicycle and driven by solar energy in due time.

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