Design and Manufacturing of Variable Speed Solar Power Bicycle

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ABSTRACT

The method of upgrades a conventional electric powered bicycle over to Solar-Powered Electrical Bicycle that is powered by an electric motor which gets its supply from photovoltaic (PV) panels. The PV panels must be mounted and installed at the electric bicycle without compromising riding comfort ability. The solar power bicycle is meant as a challenge to get, on sunny summer days, the most pedal assistance as possible out of the solar panel used. The solar power bicycle is sportive. It may not cost substantially more energy to drive the solar power bicycle, when not powered, than a normal bicycle. When there is no sunlight or the batteries are empty the bicycle should still be light running. E-bikes need large and heavy batteries to allow riding long distances, because the battery is charged only once at home.

Keywords:. ***Electric bicycle, Solar power bicycle, Variable speed bicycle.***

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1. INTRODUCTION:

Energy is one of the most vital needs for human survival on earth. We are dependent on one form of energy or the other for fulfilling our needs. One such form of energy is the energy from fossil fuels. We use energy from these sources for generating electricity, running automobiles etc. But the main disadvantages of these FOSSIL FUELS are that they are not environmental friendly and they are exhaustible. To deal with these problems of fossil fuels, we need to look at the non-conventional sources of energy. Energy Requirements Of E-Bikes :

There are numerous different things that will affect the energy use of the E-bikes. The energy requirements will vary heavily depending on the choice of route, the rider's weight, the Ebike's specifications, etc. A few of these parameters were identified in the literature review but some are dependent on actual system design.

System Design Of Charging Stations: By combining the simulation results of available energy from the solar panels with the energy requirements of the E-bikes it is possible to study different options of system design. Independent of the amount of data collected, there is some things that cannot be determined with great certainty as this report is of exploratory nature. This means that some results might not apply to a real system. To deal with this problem, it was tried throughout the report to analyse the system carefully to ensure that the drawn conclusions in the end will be relevant for a real case despite changes in for example use of the system.

2. LITERATURE REVIEW:

An Improved & Efficient PowerBicycle system with the Power of Realtime Information Sharing. [1] ChetanMahadik, SumitMahindrakar, Prof. JayashreeDeka,
This paper presents the development of an associate degree Electric Bicycle System" with an innovative approach. The aim of this paper is to show that the normal bi-cycle can be upgraded to electric one by some means– that including the development of a regenerative braking system and innovative BLDC motor control – but also uses real time sensing and the powers of crowd sourcing to improve the cycling experience.

Hardware Design Considerations for an Electric Bicycle Using a BLDC Motor [2] SrivatsaRaghunath

A traditional bicycle is a two-wheel vehicle that is propelled by the rider who delivers muscle power through pedals that rotate one of the two wheels. The rider steers the front wheel to create a force that returns and maintains the vehicle center of gravity into a stable zone whenever necessary, thus keeping the bicycle upright. An Solar Power bicycle carries batteries that deliver electric power to a motor that is coupled to either wheel. In most electric bicycles the rider can chose to use muscle power to deliver all, part, or none of the propulsion power required to maintain an adopted travel speed. Some models even sense pedal pressure and command the motor to deliver more power whenever the rider pedals harder.

Campus Mobility for the Future: The Electric Bicycle [3] Ian Vince McLoughlin, I. KomangNarendra, Leong HaiKoh, QuangHuy Nguyen, BharathSeshadri, Wei Zeng, Chang Yao.

Sustainable and practical personal mobility solutions for campus environments have traditionally revolved around the use of bicycles, or provision of pedestrian facilities. However many campus environments also experience traffic congestion, parking difficulties and pollution from fossil-fuelled vehicles. It appears that pedal power alone has not been sufficient to supplant the use of petrol and diesel vehicles to date, and therefore it is opportune to investigate both the reasons behind the continual use of environmentally unfriendly transport, and consider potential solutions. This paper presents the results from a year-long study into electric bicycle effectiveness for a large tropical campus, identifying barriers to bicycle use that can be overcome through the availability of public use electric bicycles.

Electric Bicycle Using Batteries and Supercapacitors [4] D. M. Sousa, P. J. Costa Branco, J. A. Dente.

In this paper, a traction system useful for an autonomous Electric Vehicle of individual use is described. The developed system is constituted in a first approach by two different power sources: one is constituted by batteries or by fuel cells and the other by supercapacitors. This paper describes a technical solution joining and accomplishing the usage of two energy storage systems in the same traction system. In the developed system, the supercapacitors run as element that store energy temporarily and that can be used to retrieve energy.

3. OBJECTIVES:

A. To build an electric bike that everyone can replicate with minimal cost, without electrical know-how, but be powerful and reliable at the same time.

B. To upgrade a conventional electric powered bicycle to Solar-Powered Electrical Bicycle that can be used for leisurely rides.

C. To design and develop Solar-Powered Electrical Bicycle which gets its supply by using solar energy from photovoltaic panels.

D. To study the connection between solar cells, rechargeable battery and DC electric motor.

E. To develop a low cost application for rural and remote areas where fuels are not available to drive 2 wheelers so that they can run this bicycle on renewable solar energy.

4. SYSTEM ARCHITECTURE:

The methodology used in the solar power bicycle is to convert renewable solar energy into mechanical work. The components used in the solar electrical energy are solar panel, battery, DC motor, bicycle wheel. Solar panel is used to convert the solar energy into electrical energy .this electrical energy is stored into the rechargeable battery. The electrical energy stored in the battery is used to rotate the DC motor which is attached to the wheel of the bicycle.

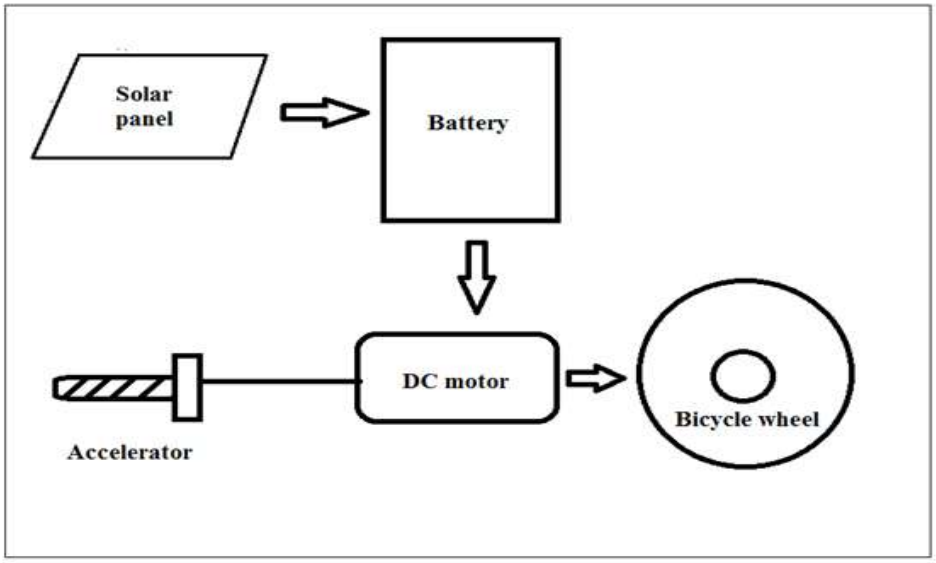

Fig.1: Block diagram of the system

Fig. 2: Fabricated model

5. HARDWARE DESCRIPTION:

1. D. C. MOTOR:

DC motor is appended to the framework with a specific end goal to give the essential torque to the chain drive and the pulley framework. Here we are utilizing 2 DC motors one for driving the sprocket of the chain drive, to move the move of the chassis.
Details- 24 volt, rpm 6.84 Nm torque.

2. BATTERY:

Batteries work by changing over compound vitality into electrical vitality through electrochemical release responses. Batteries are made out of at least one cells, each containing a positive terminal, negative anode, separator, and electrolyte. Cells can be partitioned into two noteworthy classes: essential and optional. Essential cells are not rechargeable and must be supplanted once the reactants are drained. Auxiliary cells are rechargeable and require a DC charging source to reestablish reactants to their completely charged state.
Details- 12 volt 7 Amp. Lead acid battery.

3. Solar panel

A photovoltaic (in short PV) module is a packaged, connected assembly of typically 6×10 solar cells. Solar Photovoltaic panels constitute the solar array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions.
Details- 12 volt, 20 watt 1 amp solar panel.

4. Electronic module

Electronic module contains accelerator assembly to change speed of DC motor and motor controller which are mounted behind the seat.

6. DESIGN CALCULATION:

DC MOTOR SELECTION:
Voltage=current*resistance …….(1)
24=7.5*R
R=24/7.5=3.2 ohm
The major constraint on motor operation is thermal
Pdis=I2*R…… …….(2)
Heat Heat dissipated= current through the motor squared, multiplied by the terminal resistance
Pdis= (7.5)2*3.2= 180
Force required to move weight of 60 kg
F=60*9.81= 588.6 N
Torque required for motor
T=f*r …….(3)
Assuming motor shaft to be 8 mm
T=588.6 *0.008 = 4.7088 Nm.

Power
p=(2*π*N*T)/60…..… ……(4)
P=V2/R…….(where v= 24 volt, and R= resistance 3.2) ……..(5)
P= (24^2)/3.2
P=180 watt = 200 Wat
To find RPM of motor
200=(2π*N*4.7088)/60
N=405.54 rpm…..maximum

7. ADVANTAGES:

1. Commuting with low fatigue at a top speed of 15-20 kmph.

2. Lesser maintenance cost.

3. Detachable battery can be taken inside the house for charging.

4. Handle attached accelerator - simple to operate and speed is controlled easily.

5. Solar panels keep charging the batteries for our continuous use.

8. CONCLUSION AND FUTURE SCOPE:

This project is a way of using the outgoing power and producing from wind solar panel. The concept of the project is providing ease to the rider while riding a bicycle and also to conserve energy by all possible means. When the solar power bicycle is kept under sunlight then the solar rays charge the battery through the solar panel placed above the carrier of the bicycle. The battery powers an electric motor in the back wheel. It also lowers the resistance in pedaling to make it easier to go up hills. When there is no sunlight, the bicycle can be charged by mains electricity. The solar power bicycle approach is different.

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