Available onlinewww.ejaet.com

European Journal of Advances in Engineering and Technology, 2022, 9(4s):344-348
International Conference on Tech Trends in Science & Engineering (ICTTSE) 2022
Suryodaya College of Engineering & Technology, Suryodaya Polytechnic, Nagpur, Maharashtra, India

Review Article ISSN: 2394 - 658X

A Review Paper on Solar Powered Electrical Bicycle

[1]Priyanka Gaurkhede, [2]Namrata Pote, [3]Ujwala Raghote, [4]Trupti Vaidya

Department of Electrical Engg, Suryodaya College of Engg, Nagpur
[1]priyankagaurkhede123@gmail.com, [2]namratapote44428@gmail.com, [3]ujwalaraghorte49@gmail.com, [4]vaidyatrupti758@gmail.com

---

ABSTRACT

Since the fuel values all over the world are increasing day by day thus there is a tremendous need to hunt for a substitute to preserve these natural resources. Thus, a solar bicycle is an electric vehicle that offers that alternative by attaching solar energy to charge the battery and thus provide required voltage to run the motor. Since India is blessed with nine months of sunny climate thus concept of solar bicycle is very welcoming in India. Hybrid bicycle syndicates the usage of solar energy as well as the dynamo that rounds through pedal to control the battery to run the bicycle. Thus, solar hybrid bicycle can develop a very vigorous substitute to the powered automobile thus its trade is essential.

Key words: bicycle, battery, E-vehicle, photovoltaic cell etc.

INTRODUCTION

The growing movement has straight led to weakening traffic situations, additional fuel consumption, increasing automobile exhaust emissions, air pollution and lowering worth of life. Apart from being clean, cheap and equitable mode of transport for short distance journeys, cycling can potentially offer explanations to the difficult of urban mobility. Urban mobility is a dominant problem in many cities around the world. Matters on the urban mobility touches the superiority of life and environmental sustainability are onward reputation in the world.

The world population has been increasingly focused in the cities [1]. Cities around the world are experiencing quick urbanization. Mobility in urban areas is one of the challenge that must be talked and enhanced to get a healthier quality of life for the civic [7]. The growing mobility has strong connection to the traffic situations, extra fuel consumption, automobile expend emissions, air pollution, and quality of life. Urban mobility is a predominant problem in many cities around the world. Problems on the urban mobility touches the quality of life and environmental sustainability are ahead importance in the world.

Cycling can be measured as one of the answers for urban mobility glitches particularly for short distance trips. Cycling bids many paybacks to the problem of urban mobility

A solar bicycle is a bicycle which innings using the electrical energy of battery to run the motor which eventually runs the bicycle. Solar energy is used to charge the battery. Battery gives the required voltage to the motor riding on the front wheel to run the bicycle Ease of Use

PROBLEM STATEMENT:

The above literature review discloses some glitches linked with solar powered electric bicycle, listed as follows:

Use of external BLDC motor [3]'- touches the scheming and makes the system difficult. BLDC motors can be brutal on the drive system. It also origins jerky or awkward motor timing during hill climbing and around obstacles.

Solar energy is not steady with climate changes. [1]'- along with the climate varying, the electricity permanently varies with the light strength. The clouds, seasons, day and night and thrilling climate can touch the power from solar cells.

The extreme speed of bicycle when external BLDC motor used is only about 30-35km/hr. [2]'- BLDC motor is associated superficially through chain arrangements; losses occur due to friction. They cannot be used in reformative circumstances and hence lessens the speed.

OBJECTIVES OF PROJECT

- To use motor to streamline the design.
- Attaching energy from multiple sources using dynamo, regenerative braking techniques and solar panels.
- Enlightening the speed of bicycle.

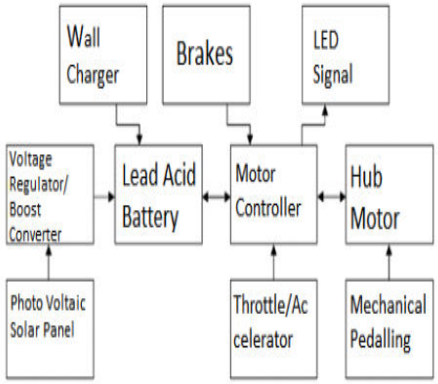
Using motor, harnessing energy from various sources and improving the speed of the bicycle, an eco-friendly and efficient vehicle can be realized. secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as "3.5-inch disk drive".

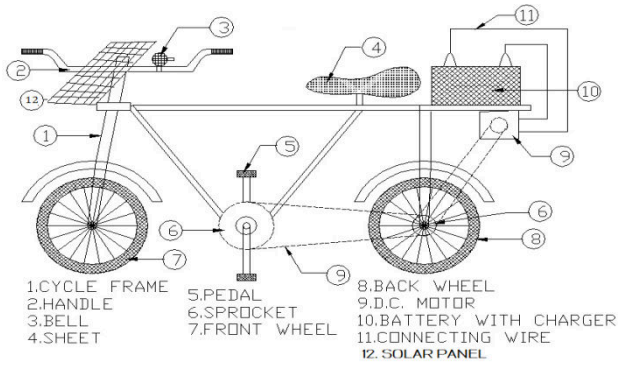
SOLAR POWERED ELECTRIC VEHICLE

- A solar bicycle is a bicycle which runs using the electrical energy of battery to run the motor which ultimately runs the bicycle. Solar energy is used to charge the battery. Two or more Photovoltaic cells may be used to harness solar energy to generate voltage to charge the battery. Battery gives the required voltage to the hub motor mounted on the front wheel to run the bicycle.
- Solar powered electric bicycles use photovoltaic cells that convert solar energy into required voltage to charge the battery. There are two types of solar panels that are generally used that is polycrystalline panels and microcrystalline solar panels. The polycrystalline panels are having less efficiency as compared to microcrystalline panels. Polycrystalline panels have efficiency of approximately 15 – 20% while microcrystalline panels have efficiency of 50 -60%.
- There are different types of batteries used in electric vehicles like lead acid batteries, lithium ion batteries, Nickel cadmium batteries, etc. Different batteries they have their different advantages for different applications. As far as solar bicycles are concerned lead acid and lithium ion batteries are most commonly in use.
- Lead acid batteries have lower cost, higher current carrying capacity but have smaller life and are heavier. While lithium ion batteries have lower weight but higher cost and there are chances of explosion.
- Solar bicycles have gathered attention from all over the world and there have been many projects being done on this topic. The motor used is a permanent magnet Hub motor which will be mounted on the front wheel. While a belt and pulley mechanism will be provided on the rear side of the vehicle to run the dynamo.

COMPONENTS REQUIRED

- Hub motor
- Solar panel
- Lead acid battery
- Motor voltage controller
- Accelerator
- Bicycle
- Dynamo
- Charge Controller





The diagram of electric bicycle determined by DC motor trim on middle shaft of bicycle & operated by battery energy shown in figure. The solar Battery riding on carriage. Solar battery generates 12V power when sun light falls on that and its stations are linked to charge controller [6].

Dynamo is mounted on side shaft of bicycle, supports in such a fashion that dynamo shaft is touching the back-wheel tyre. As wheel rotates dynamo shaft rotates and generates 12V power. Its terminals also are connected to charge controller. When the bicycle is idle in day time, the electrical devices will charge the battery. thanks to non-uniform sunlight and ranging in wheel speed, output voltage from both solar panel and dynamo is varying in nature. Charge controller adjusts the constant voltage of 12 volt and charges the battery. The facility acts in parallel with the power delivered by the rider via the pedaling. The rider of a solar bicycle can opt the motor completely or pedaling (as in conventional bicycle).

1. BRUSHLESS PMDC MOTOR:

In this project 24v, 350W magnet dc motor is employed.

2. SOLAR PANEL:

Solar power is that group of electricity from sunlight. Alternative is that alteration of sunlight to electricity. Sunlight are often changed directly into electricity using photo voltaic (PV) panel [5].

3. CHARGE CONTROLLER:

It is vital to switch the voltage output from the solar array before it is full to the battery. A charge controller is a power converter with an output DC voltage greater than the input DC voltage. This is used to regulate an input voltage to a higher regulated voltage

4. DYNAMO:

Dynamo is recycled to brand electric power. A dynamo is an electrical generator that harvests power with use of a commutator. Dynamo is located on rear wheel of the bicycle and dynamo commutator is linked with rear wheel of bicycle.

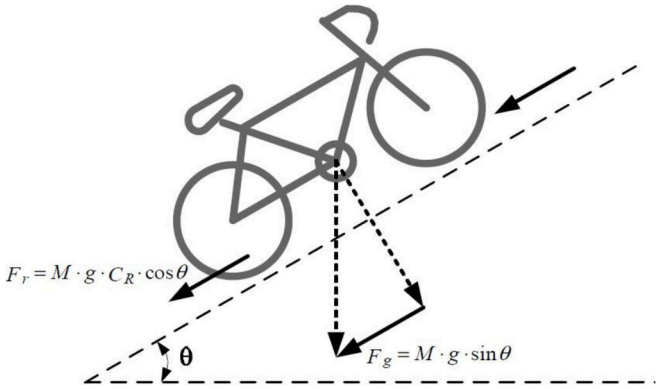
5. MOTOR VOLTAGE REGULATOR:

Voltage regulator boards the power level as per need. The voltage regulator cast-off in this project acts as a tapping switch. In our project two voltage levels are recycled.as per essential voltage levels regulator can be agreed The world population has been progressively absorbed in the cities [1]. Cities everywhere the world are experiencing rapid growth. Elasticity in urban areas is one of the tasks that must be lectured and enhanced to get a better quality of life for the community [2]. The increasing mobility has strong correlation to the traffic conditions, extra fuel consumption, automobile exhaust emissions, air pollution, and quality of life. Urban mobility is a prevalent problem in many cities around the world. Issues on the urban mobility affects the quality of life and environmental sustainability are gaining importance in the world.

6. ACCELERATOR / THROTTLE:

This solar electric bicycle thumb throttle is easy to use and great for those that want to keep their original handlebar grip. Typically, the thumb throttle is used on bikes that have a twist gear changing system. Thumb throttle that said it comes down to personal choice as the thumb throttle can also be used on a bike that has a thumb gear changing system. A “Thumb Throttle” refers to a method of controlling the speed of an engine or motor.

DESIGN CALCULATION:



Diameter of the bicycle wheel D = 0.66m Radius r = 0.33m
Speed required s = 30km/hr Bicycle weight Wb= 20kg
Weight of the rider (Approximately) Wr = 70 kg Total weight Wt = 90 kg

POWER CALCULATION

Normal reaction on each tyre Wn = Wt/2 = 45 kg
Force F = Wn * g = 45* 9.81 =441.45 N

1. Considering static friction:
static friction coefficient u = 0.03
Fs = u * F = 0.03 * 441.45 = 13.24 N
Torque Ts = Fs * r = 13.24 * 0.33 = 4.37 Nm

2. Considering dynamic friction:
static friction coefficient u = 0.004
Fd = u * F = 0.004 * 441.45 = 1.765N
Torque Td= Fd* r = 1.765 * 0.33 = 0.5827 Nm
1. Angular Speed:
w = velocity/radius = 30,000/ (0.33*3600) = 25.25 rad/sec

POWER REQUIREMENTS

1. On plane Ground
for static condition Ps = Ts*w = 4.37 * 25.25 = 110.34 W for dynamic condition Pd = Td * w = 14.71 W
overall power requirement = 110.34 * 2 = 220.68W

2. On inclined surface
let angle of inclination a = 2’
total force required is
a] considering static friction
F = u * m*g * cos (a) + m*g sin (a) =57.28 N
therefore, power required = F*V = 477.33 W extra power required = 477.33 – 220.68 = 256 W
b] considering dynamic friction
F = u * m*g * cos (a) + m*g sin (a)= 34.34 N
Power P = F*V = 286 W
By considering the above calculations we require 350W hub motor.

CHARGING ADAPTER SELECTION

Charging current should be 10% of the Ah rating of the battery. Therefore,
Charging current of adapter = battery Ah * (10/100) = 1.5 A
Due to some losses, we may take 1.5- 3.5 Amperes for battery charging purpose instead of 1.5 Amp.
We select 24V 3A charging adapter.
Calculation of charging time of battery:
Charging time of battery by adapter = Battery Ah / charging current. Charging time for 15Ah battery = 15 Ah/ 3 A = 5 Hrs.
It is for ideal cases

Practically, it has been noted that 40% losses occur in case of battery charging. Then 15*(40/100) =6Ah.
Therefore, 15+6 = 21Ah (15Ah + losses) Now, charging time of battery = 21 Ah /3A = 7 Hrs.

SELECTION OF SOLAR PANEL

We use two panels of 50 W ,12 V each having dimension 350mm* 550 mm connected in series to provide 24V output.
Charging time of battery when charged by solar panels:
Charging time of battery by adapter = Battery Ah / charging current. Charging time = 15 Ah / 2.5 A= 6 Hrs.
The calculation provides the required rating of the devices that are to be used in the project. These rated components are assembled in a proper manner to develop our project. The outcomes of all these are analyzed and discussed in the next chapter.

REFEREENCES

[1]. Prasanna P. Titarmare, Ankit Salunke, Hemant Turkar, Mangesh Sahare, Snehal Nimgade, and Sachin Katole. "Microcontroller Based Solar Grass Cutter" Internation Journal of Advance Research and Innovative Ideas in Education Volume 7 Issue 2 2021 Page 1378-1381.

[2]. Prof. Prasanna P. Titarmare Komal Choudhary, Harshada Kawale, Sagar Navghare, Swapnil Bendre, "Dual Axis Sun Tracking with an Automated Cleaning System for Pv Modules", 2019/12, IOSR Journal of Engineering (IOSRJEN), Vol. 9, PP. 42-45.

[3]. 'Sunikshita Katoch et al.,', "Design and Implementation of smart electric bike" - International Journal on Innovative Technology and Exploring Engineering-2019.ISSN:2278-3075 April 2019.

[4]. 'Nitipong Somchaiwong and Wirot Ponglangka', "Regenerative Power Control for Electric Bicycle". 'SICE-ICASE International Joint Conference 2006'.

[5]. Rahul Dekate, Prasanna Titarmare, ASHISH POLKE, Jitendra Gokhale, Shubham Kokate, Ankush Gupta, Parag Chincholkar, and Pragati Bawane. "IMPLEMENTATION OF VOICE OPERATED LIFT SOLAR BASED(BLIND)" Internation Journal of Advance Research and Innovative Ideas in Education Volume 7 Issue 3 2021 Page 2936-2942

[6]. Prasanna P. Titarmare, Ankit Salunke, Hemant Turkar, Mangesh Sahare, Sachin Katole, and Snehal Nimgade. "An Arduino Based Solar Grass Cutter" Internation Journal of Advance Research and Innovative Ideas in Education Volume 7 Issue 2 2021 Page 1382-1387.

[7]. Prof. Prasanna Titarmare Komal Choudhary, Harshada Kawale, Sagar Navghare, Swapnil Bendre, "Dual Axis Sun Tracking for Solar PV Modules with an Automated Cleaning System", International Journal of Emerging Technologies and Innovative Research (www.jetir.org), ISSN:2349-5162, Vol.7, Issue 5, page no.25-28, May 2020,

[8]. Ajit B. Bachche, N. S. Hanamapure, "Design and Development of Solar Assisted Bicycle", International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 6, December 2012.

[9]. T. Bhavani, K. Santhosh Kumar, K. Dhiraj Kumar," Novel Design of Solar Electric Bicycle with Pedal Assistance", ISSN No: 2348-4845 International Journal & Magazine of Engineering, Technology, Management and Research

[10]. Muhsin Abdur-Rahman, Bo Hu, Erik Cheever, Fred Orthlieb, Grant Smith," Design and Implementation of a Hybrid Electric Bike", Engineering 90 Senior Design Project, May 05, 2005.

[11]. Mayur Parmar, Rushi Trivedi, Santosh Nair, Vikit Vora," Solar Powered E-Bike", Imperial Journal of Interdisciplinary Research (IJIR) Vol-2, Issue-5, 2016 ISSN: 2454-1362.