

Dual Purpose Portable Solar Bike with Optimized Design (May 2018)

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Abstract - The face of the automotive industry is being reshaped by concerns over oil supplies, international policy and fuel costs. The solar vehicles and rechargeable batteries, one of the oldest alternative energy transportation, has many applications to the emerging electric vehicle market. The development of a telemetry system for a solar portable bike aids in a better understanding of the energy usage of a vehicle and the aspects applicable to electric vehicles as a whole. This project can give us a better option for personal traveling, with easy handling of bike as a bag which is light weight and it has also storage space for carrying things. It helps to become green India and gives an ecofriendly option to traveling and compact vehicle. The basic principle of solar portable bike is to use energy that is stored in a battery during and after charging it from a solar panel. The charged batteries are used to drive the motor which serves here as an engine and moves the vehicle.

Key Words: solar vehicle, IC engine, bike, DC Motor, portable, bag, product, batteries and vehicle.

1. INTRODUCTION

A solar portable bike is an electric compact vehicle that can be used as a luggage, powered completely or significantly by direct dc electrical energy from batteries which are charged by solar energy. Usually, photovoltaic (PV) cells contained in solar panels convert the sun's energy directly into electric energy and these stores in lead acid batteries.

The term "solar vehicle" usually implies that solar energy is used to store power in batteries and run all or part of a vehicle's propulsion. Solar power may be also used as a portable DC power pack to provide power for charging mobiles laptops etc. and controls indicating lights, horn and other auxiliary functions. In this course work, the characteristic features of the components: solar panel, charge controller, battery, power converter and DC motor required for the vehicle application were studied in design forecast were modeled individually and the complete hardware integration of the system is modified to meet the application requirement.

A. History

The first combination of photovoltaic devices and electric vehicles happened in the late 1970's. To generate more publicity and research interest in solar powered transportation, Due to the unique nature of the solar community and events, these technologies remain an untapped resource. Significant improvements and understanding of electric vehicles has been developed that

can be applied to a broader range of automobiles to provide more efficient and cleaner alternatives over combustion engine vehicles.

B. Problem Definition

Now the India rapidly becomes most pollutant nation in world, we can test those pollutants in our mouth at urban cities like Delhi, Allahabad, and Gwalior etc. According to report of 2012 there are 37 million motorcycles are holds in India. China is nearly close to India with a number of 34 million motorcycles. In the major cities 72% pollution created by only vehicles, there are no of bikes and motorcycles are registered every day. Energy to drive vehicles is one of the most vital needs for human survival on earth. We are dependent on conventional form of energy it's time to work on non conventional, unexhausted energy sources like solar energy for drive the vehicle for transportation. One such form of energy is the energy from fossil fuels. 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, India has major share in diesel and petroleum for IC Engine bikes, we need to look at the non-conventional sources of energy.

Although the lack portability of IC engine bikes, due to which various problems arise like traffic jam in urban areas, where temperature is sensibly raises in current era. The heaviness and bulkiness of IC engine bikes is the main problem, we need to discover better option for it.

C. Vehicular Pollution Problem in India

High vehicle density in Indian urban center, Carbon monoxide is a colorless, odorless, poisonous gas Ground-level. Ozone is the major component in what we know as smog with nitrogen oxide Sulfur dioxide exposure constricts air passages, creating problems for people with asthma and for children have weak lungs need to more care than adults' lungs. The effect of NO_x exposure on the respiratory system is similar to that of ozone and sulfur dioxide. Lead poisoning can reduce mental ability, damage blood, nerves, and organs, and raise blood pressure. Formaldehyde and Benzene from automobile emissions are known to cause are causing cancer, birth defects, genetic mutation or other serious illnesses in people. The chemicals can be inhaled directly or carried by small particles (dust or lint) into the lungs.

D. Objectives

The main objective of this project is can give us better option for personal traveling, with easy handling of bike as a

bag. The use of solar energy is that they are pollution less, since no pollution they are very eco-friendly and are the only answer to the increasing pollution levels from automobiles in the present scenario.

II. LITERATURE REVIEW

John Connors [1] introduced in his study the solar vehicle solves many problems related to the environment and is the best pollution free method. We need to make use of them so that we can reduce our dependence on fossil fuels.

Aditya Pratap Singh [3] says that when the performance of motor decreases with age increases, it is required to measure the performance of BLDC motor for regular efficient operation. For the satisfactory life of motor, PID controller is used.

M. W. Daniels and P. R. Kumar [4] show that the basic principle of solar car is to use energy that is stored in a battery during and after charging it from a solar panel. The charged batteries are used to drive the motor which serves here as an engine and moves the vehicle in reverse or forward direction.

G.SUDHA1 [5] this paper was written to reflect on the work done on the implementation of a fuzzy logic PID controller.

Rizzo, G. [6]his work shows The integration of photovoltaic panels in electric and hybrid vehicles is becoming more feasible, due to the increasing fleet electrification, to the increase in fuel costs, to advances Photovoltaic panel technology, and the reduction in their price.

Yogesh Sunil Wamborikar, Abhay Sinha [7]they says that need to make use of renewable sources of energy so that the non- renewable sources of energy do not get exhausted.

Chandrasekaran, K. [10] introduced about Solar Energy Corporation of India Limited (SECI) reserves the right to modify, amend or supplement this RFS document including all formats and Annexure.

III. BASIC WORKING PRINCIPLE

Fig. shows the basic working diagram of solar portable bike. By using solar panel sunlight is directly converted into DC current, collect in lead acid batteries through voltage controller. After that power used to rotate the DC motor with speed controlling action by throttle. Motor gives torque to rear wheel at very good speed. When loaded of vehicle near about 35 to 45 km per hr.

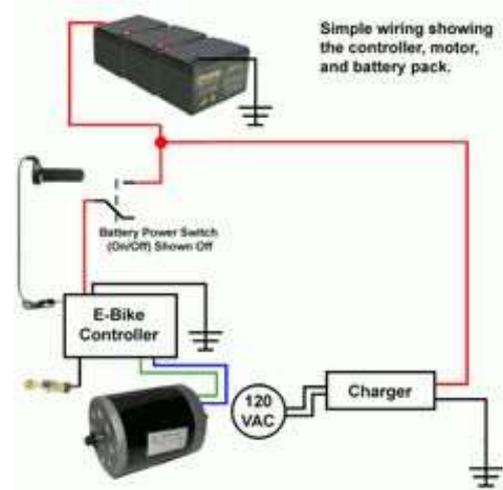


Fig -1: Basic Working Diagram

A. MATERIAL FUNCTION

Various types of electrical components were used for making the Solar Portable Bike. Some of them with average price are mentioned below,

Sr.No.	Component	Specification
1	DC Motor (MY1016)	24V 250W
2	Speed Controller And Throttle	(XCLUMA) 24V 350W
3	Solar Panel	250W
4	Batteries	(12V 7A)×2
5	Fabricating Material	Metal sheet, Steel pipes, Wood, Bearings, Chain drive and Sprocket,Wheels, etc.
6	Accessories and Attachments	Indicating lights, horn, charging port, etc.

a. DC Motor

Motor used in this project is E-bike motor has model no.

MY1076, 250Waat, 24Volts, 2650 revolution per minute, it comes with an 11-tooth, 25-chain sprocket as well as a 4 bolt mounting bracket (threaded M6) on the base. As this is DC motor capable of rotation in either the clockwise or counterclockwise direction by just reversing the battery polarity to the motor and can be speed control. Specification and feature are as follows,

- Output power : 250 W □ Supply voltage : 24V DC
- Speed : 2650 rpm
- No load speed : 3000 rpm

- Full load current : $\approx 13.7\text{ A}$
- No load current : $\approx 2.2\text{ A}$
- Weight : 1.92kg
- Rated torque : 0.80 Nm (8 kg.cm)
- Stall torque : 5N.m (50 kg.cm)
- Efficiency : 78%

b. Speed Controller and Throttle

The speed control of the DC motor is the important part of the vehicle. For controlling speed of the motor, the switch uses pure Nichrome wire for resistances hence limiting the current that flows in the motor. The switch has been provided with two terminals; one for the motor connections and the other for the battery connections. The arrangement of the switch is more or less like a rheostat. The different setting throttle gives different resistance points result in speed variation from zero to top in minimum time.

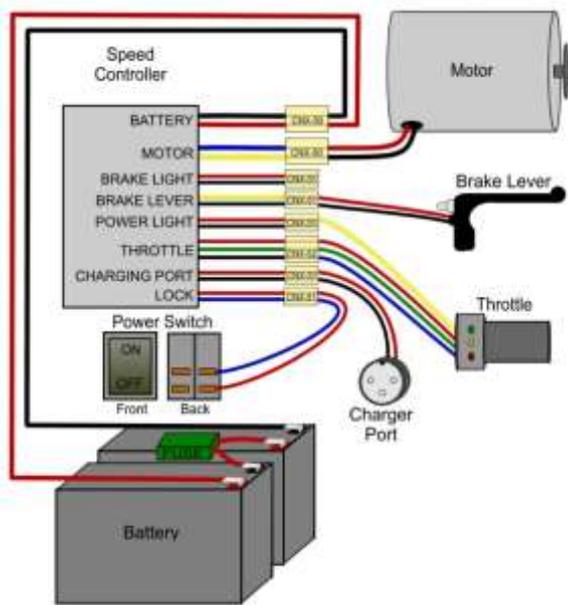


Fig -2: Wiring Diagram

c. Solar Panel and Batteries

The HB SP01 solar panel used in the solar vehicle is of the rating of 100 W 21.6 V. The maximum solar energy is obtained between 10am to 4:30pm. The solar module moves as environmental condition, used to charge the batteries via charge controller under some condition. The battery can fully charged again within 4hrs-4.5hrs. The batteries are continuously charged by the solar panel but to increase their rate of charging, the panel should be moves in such a way that it receives maximum sun rays so that it gives its maximum efficiency. The solar cell used in the vehicle is multi- crystalline. The reason behind using the multi crystalline cell is that it is more efficient than the mono-

crystalline cell, with anti-reflecting coating and has impeccable finish and optimum quality. Model no. : HB SP01 has Specification and feature is as follows,

- Polycrystalline solar panel
- Rated power range : 60-100 W
- Module voltage : 12 V
- Size : 80×70×3 cm
- Module efficiency : 13.9

Lead-acid battery is used in this vehicle due to low cost, and less maintenance. It's a 24V 10A battery works as a power pack of vehicle.

d. Chassis

The basic structure made of MS square pipe wireframe is Strong, light weight, durable to sustain all loads and give support all components assembled on it. One spring suspension is provided at rear wheel to sustain all shock loads before fill driver. Wood and sheet metal is used for seating and assembling components (motor, batteries, bearing etc.) as required. There is solar panel is open as a wings and has provision to fold when it does not require, at in night or solar panel is difficult to carry in places where huge rush. by using hinges and magnetic touch locks are fastened to main chassis. Finally whole body covers with water proof and scratchproof synthetic fabrics with good aesthetics. Specifications are as follows,

- body Height : 35 cm
- body Width : 17 cm
- Body length :56 cm
- Ground clearance: 7 cm
- Height from ground : 42 cm
- Handle height : 58 cm
- load capacity : 100 kg
- whole product weight after assembly : 16.75 kg

e. Wheel and Steering System

One rear driven wheel of diameter 20 cm and two front wheel of diameter 8 Cm are used. Specially designed steering

system is introduced , consist of two wheels work as a one unit with thrust bearing bike handle used for sustain major load when riding, both wheel rotate relative to each other and gives as differential effect. Steering has zero caster angle suitable for this speed range gives good balance need not attachment for stand bike in ideal condition. When we use telescopic handle two wheels insure to easy carrying as bag..



Fig -3: CAD Drawing of Steering System

f. Brake

There is special type brake required, for safety from burning it due to making hotspot in winding of motor. Need of stopping electric current flowing through motor when applying mechanical brake, for it we use small on-off press switch near hand brake lever that cut the electric circuit when press it.



Fig -4: Setup of Break

g. Accessories and Attachments

There are various accessories for, safety during riding, easy handling, and extra attachments for charging and foldable solar panel. Head light, Tail light, Side indicator light, Horn are introduced needed during riding on portable bike that all run on battery power. In build plastic mudguards are bolted at front rear wheel to insure that rust, water and unwanted sludge is not come inside of bag. Also there are attachments of foot paddle, storage security lock etc.

B. FABRICATION

Preparation of fabrication includes many fastening process i.e.; welding, riveting, bolting, gumming, coloring sheet metal working, carpentry, cushioning, First of all we make a wireframe for chassis can take load about 100 Kg. make some wooden and metal sheet platform for placing components and seating arrangement. Assemble all the components with above mentioned specifications. The key point is aesthetics of product is compact, lightweight easy to carry any ware. Attach some accessories and give connections to complete electric circuit. Finally cover all the components with good quality water proof fabric material with special storage space for wants (laptop mobile cloths and other) by applying gum.

Riding Tips and Safety

The Solar portable bike is unique rid able luggage. Do not jump off a moving vehicle. Always come to a stop before getting off. If exceed the ability of the product, such as riding over obstacles, uneven terrain, slippery surfaces, loose materials, or steep slopes, you will lose control, leading to collisions, falls, and injury. Avoid sharp ups and deeps surfaces, more watered i.e. in rainy Saigon because of it is not 100percent waterproof, also avoid steep slopes, and obstacles. If you cannot avoid a slippery surface, loose material, steep slope, or obstacle, then you must carry or tow your solar portable bike to move across it. When riding, keep both hands on the handlebars and both feet on the foot pegs. Be relaxed.



Fig -5: Final Setup

C. Advantages and Limitations

Due to compactness it require less space, as well as easy to caring because of its less weight. The solar vehicles are the future of the automobile industry. They are highly feasible and can be manufactured with ease. The main advantages of a solar vehicle are that they are pollution less and are very economical. Since Portable Solar Bike with Optimized Design cause zero pollution it is very eco-friendly and gives perfect answer to the increasing pollution levels from automobiles

in the present scenario. By harvesting the renewable sources of energy like the solar energy we are helping in preserving the non-renewable sources of energy. The other main advantages of the product are that it requires less maintenance as compared to the IC engine motorcycle and are very easy to carry any ware.

Solar vehicles do have some disadvantages like small speed range, initial cost is high. Also, the rate of conversion of energy is not satisfactory (only 17%). But these disadvantages can be easily overcome by conducting further research in this area. Although it has not 100% run on solar energy due to environmental conditions and space available.

D. APPLICATION

- Use as a portable bike.
- Use to store luggage in traveling.
- Use at tropical areas where normal vehicles can't go.
- We can carry it easily on signals.
- Helps some handicaps and elders.
- Optimal use on airport railway stations, on 30-40kg short distances.
- Easy handling in travelling.

IV. CONCLUSION

'Dual Purpose Portable Solar Bike with Optimized Design' is project to make ecofriendly, zero pollution vehicle option for IC engine motorcycle with affordable price. As this field of automobiles will be explored the problems will get solved. It can easily carry as a bag or ride on it with good speed. It can be used to cover short distances and at the same time keep the environment pollution free.

REFERENCES

- [1] "SOLAR VEHICLES AND BENEFITS OF THE TECHNOLOGY", by John Connors, ICCEP paper 2007
- [2] www.electricvehicle.com for the electrical design of the vehicle and technologies used in this project.
- [3] Aditya Pratap Singh, "Speed Control of DC Motor using Pid Controller Based on Matlab", Innovative Systems Design and Engineering, Vol.4, No.6, 2013-Selected from International Conference on Recent Trends in Applied
- [4] M. W. Daniels and P. R. Kumar, "The optimal use of the solar power Automobile," Control Systems Aditya Pratap Singh, "Speed Control of DC Motor using Pid Controller Based on Matlab" Innovative Systems Design and Engineering, Vol.4, No.6, 2013 - Selected from International Conference on Recent Trends in Applied Sciences with Engineering Applications.

- [5] G.SUDHA1, "Performance Based Comparison between Various Z-N Tuning PID And Fuzzy Logic PID Controller In Position Control System Of Dc", International Journal on Soft Computing (IJSC) Vol.3, No.3, August 2012.
- [6] Rizzo, G. (2010), Automotive Applications of Solar Energy, IFAC Symposium Advances in Automotive Control, July 12 - 14 2010, Munich, Germany.
- [7] Sunil Wamborikar, Abhay Sinha, Yogesh, "Solar powered vehicle", WCECES Paper 2010.
- [8] H. Shimizu, J. Harada, C. Bland, K. Kawakami, and L. Chan, "Advanced concepts in electric vehicle design," IEEE Transactions on Industrial Electronics, vol. 44, no. 1, pp. 14-18, 1997.
- [9] R. Anbazhagan Middle-East Journal of Scientific Research 20 (6):693- 696, 2014.
- [10] Chandrasekaran, K. (2016). Solar Energy Corporation of India plans to set up more solar plants. The Economic Times [Online] 3 May. Available from: http://seci.gov.in/upload/files/what_new/pressrelease/57284c2ebff64SolarEnergyCorporationofIndiaplanstosetupmoresolarplantsTheEconomicTims.pdf

BIOGRAPHIES



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