



Solar Operated Multipurpose E-Rickshaw

Gaurav Kumar¹; Alok Kumar Gupta²; Om Prakash³; Deepak kumar⁴ & Sumeet kumar⁵

Mechanical Dept. , SSPACE, RTM Nagpur University

¹grv0558@gmail.com; ²guptaalokkumar66@gmail.com; ³er.omprakash002@gmail.com;

⁴dpk005@outlook.com; ⁵sumeetk384@gmail.com

Abstract:

Solar power is produced by collecting sunlight and converting it into electricity. This is done by using solar panels, which are large flat panels made up of many individual solar cells. It is most often used in remote locations, although it is becoming more popular in urban areas as well. Solar energy is the renewable energy. Solar powered e-rickshaw can be described as the application of solar energy to power an electric motor rotates a blade which moves the wheel of the e-rickshaw. It is a low maintenance, low running cost, eco-friendly and non-polluting product and can be used for all kinds of personal mobility solutions. Pollution is marinate and can be seen in own homes. In case of gas powered rickshaw, emission of gases it is responsible for pollution and also the cost of fuel is increasing hence it is not efficient. To reduce the dependence upon fossil fuels and the air pollution from gas powered rickshaw. It has been suggested as a way to replace bicycles in India with vehicles that will enable carriers to travel farther and carry more at a lower cost.

KEYWORDS: battery electric vehicle; auto rickshaw; recharging infrastructure; energy storage; renewable energy

1. INTRODUCTION

Solar energy is the renewable energy. Solar powered e rickshaw can be described as the application of solar energy to power an electric motor rotates a blade which moves the wheel of the e rickshaw. It is a low maintenance, low running cost, eco-friendly and non-polluting product and can be used for all kinds of personal mobility solutions. Solar powered e-rickshaw can be described as the application of solar energy to power an electric motor rotates a blade which moves the wheel of the e-rickshaw. India is home to over 2.5 million auto rickshaws. In recent years, rickshaw companies have come out with alternative models such as Compressed Natural Gas (CNG) and Liquefied Petroleum Gas (LPG) rickshaws to mitigate the pollution problem caused by traditional petrol models [Rajkumar, 1999]. Two main disadvantages exist with incorporating those technologies on the rickshaws:

1. Oil is still added to the chamber in the two stroke configurations, which adds to the pollution, and
2. LPG and CNG are nonrenewable energy sources. The best way to redesign the rickshaw is to make the main power source renewable. One way to do this is to use an energy system that can take advantage of several sources of renewable energy – namely, electricity. Rickshaws are an ideal candidate for electrification due to the low speeds of the vehicle and a relatively small distance covered in a day. Therefore, we have set out to make auto rickshaws the example of environmental consciousness in India by replacing the existing hydrocarbon- powered vehicles with electric vehicles and recharge the batteries using mostly renewable energy sources.



2. LITRATURE REVIEW

2.1 Solar Power rickshaw can Diminish the physical labor of rickshaw puller

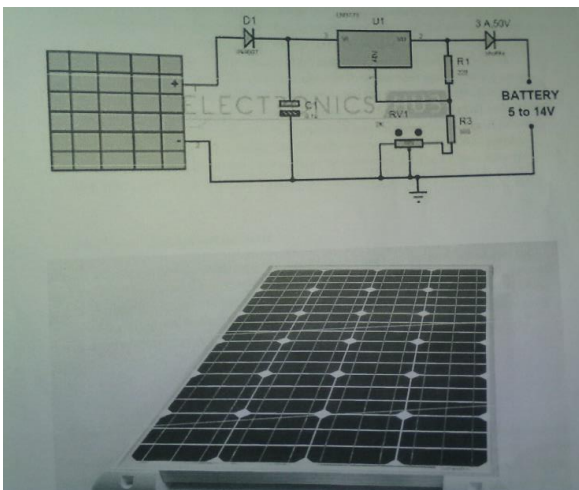
Four 75W solar panels over the rickshaw ceiling for battery charging. It was proved that the panels were insufficient for charging the batteries to run the 500W motor for a long time. To solve this problem, it is necessary to charge the batteries using electricity from the national grid, so a parallel charging mechanism is used for additional charging purpose excluded from the panel charging system. This hybrid „green“ rickshaw can play around 10 hours.

The SPR can run at 25 km per hour. The SPR has a longer battery life time because of infrequent charging. SPRs are faster than conventional Rickshaws, needless human effort to be plied on the street. From the types of SPR mentioned earlier in the paper, the latter one is the most economical & feasible for practical use. Solar Power is absolutely dependent on the availability of sunlight, so in case of rainy and foggy day, when the sun isn't visible, it will not be able to work properly.

- The development of a telemetry system for a solar powered vehicles aids in a better understanding of the energy usage of a vehicle and the aspects applicable to electric vehicles as a whole.
- This paper gives an idea about the future vehicle multipurpose compact vehicle which can be used for transportation, surveillance, special vehicles and to give a new idea and open a new path which would further help us to replace conventional appliances and electric appliances by solar appliances
- when the first Solar car of India SAPPHIRE was launched in India which was first of its kind in India and after that Solaris never looked back and made world to look a new world of exploration in which vehicles ran using solar energy and till now Solaris has made 5 cars and presently working on 6th car. Following are the different cars made :-Sapphire'06, Solaris'08, Avenir'11, Solarik'12, Arka'12.
- The environmental, economic, and political concerns over combustion vehicles will contribute to an increase in the use of electric vehicles and drive further advances in battery technologies vehicle efficiencies.

2.3 Comparative Study of Solar Rickshaw with Conventional Auto Rickshaw

A solar vehicle is an electric vehicle powered completely or significantly by direct solar energy. Usually, photovoltaic (PV) cells contained in solar panels convert the sun's energy directly into electric energy. The term "solar vehicle" usually implies that solar energy is used to power all or part of a vehicle's propulsion. Solar power may be also used to provide power for communications or controls or other auxiliary functions.



FIG

1: Parallel charging mechanism

2.2 Design and Development of Solar Electric Vehicles

Table:1 Comparison Table Of Solar and Auto Rickshaw

ITEMS	AUTO RICKSHAW SPECIFICATIONS	SOLAR RICKSHAW SPECIFICATIONS
Wheel Track	1070 to 1160 mm	36"
Total Length	2150 to 2900 mm	50"
Total Width	1200 to 1350 mm	32"
Maximum Height	1650 to 1950 mm	66"
Engine	2 stroke, 4 stroke, CNG kit	DC series motor
Brake	Hydraulic / Mechanical	Disk Brake
Piston displacement	Less than 100 cc	Not required



Fuels	Petrol, CNG, LPG	Solar panel
Capacity of Fuel Tank	minimum 4 litter	Two batteries of 12V 30Amp

- Basic concept of our solar model

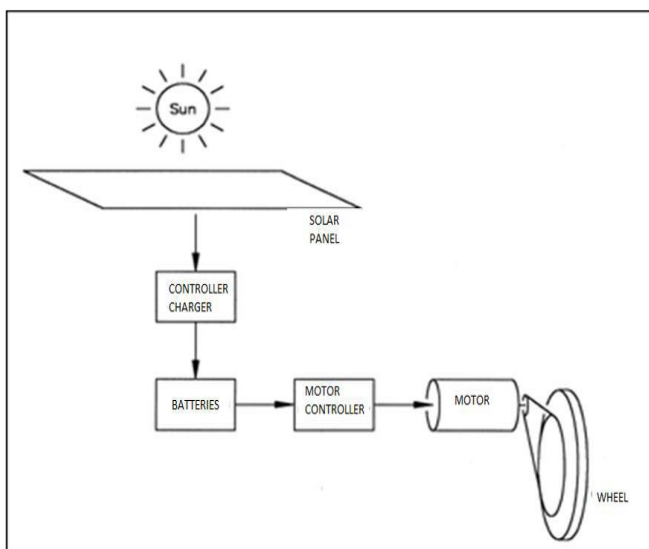


FIG 2: Basic Block Diagram of our Solar Model

2.4 Performance Evaluation Of Solar Power Vehicle

• Power Requirements

The power required for riding the tricycle is 1000 W. The solar power is used to assist the rider. Hence a motor of lesser power of 850 W is selected. The system can independently develop a speed of 35kmph.

• Battery Specifications

Battery of voltage 12 V is selected

• Solar Panel Selection

Two solar panels of 24 V capacities is used to charge the battery. To develop a voltage of 48V. The solar cells are electrically connected as a module with a glass sheet at the top. It consists of photovoltaic cells which converts solar energy into electric current.

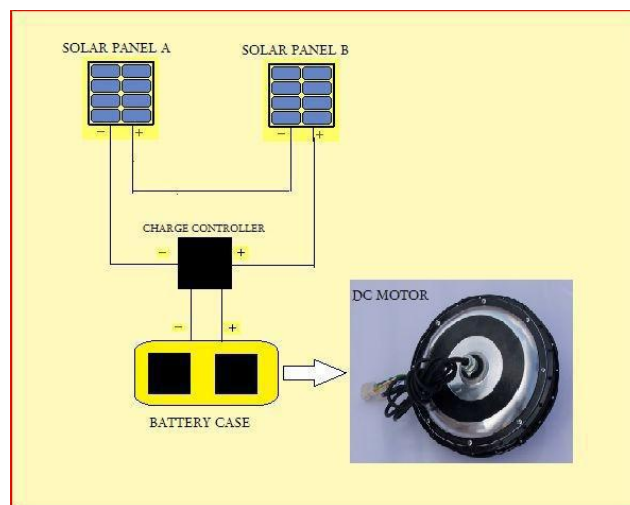


FIG 3: Circuit for Solar Panel

- A solar powered tricycle is a feasible alternative for local trip.

2.5 Design of Solar Powered Vehicle

The greatest problem that faces the world today is Global warming. It is more apparent here in India than anywhere else , specially Rajasthan where temperatures over the last few years have risen from 32deg C to 36deg C to last summer of 42deg C to 46 deg C.

Solar plate are made of 2 thin plates of silicon containing slight impurities which when exposed to sunlight experience a stimulation of electrons. If positive and negative terminals connected by a wire are added, as in a battery, the electrons will flow round the wire producing electricity. Solar rickshaw is capable of a speed of 25-40 km/h.

Capable of climbing up hill on an average inclination of 15deg to 30 deg.

Individual Constituent parts Of Prototype:

Solar panels-85 Watt BP solar panels placed on the roof and
Motor-Lynch motor, weight of only 9 kgs. At 12 Volts the motor can run at 2.5 KW aprox 4 HP

Batteries-. The batteries are 2 x 12 Volt Exide sealed traction, deep discharge batteries.

Solar Controller-The Solar controller is like a fuse which regulates the current from the panels to the motor.

Running gear-Bicycle wheels with spokes have been used and on later versions stronger wheels will be used. A differential is incorporated in the back axle and 3 speed Strummy archer gears used in the drive system.

Brakes- Hydraulic disc breaks are fitted to all 4 wheels.

2.6 Fabrication of Solar Transport Vehicle

- In this project auto rickshaw has been selected, because hybrid vehicle normally use electric motor as an



additional source. Since electric motor can produce high torque and low speed. Thus for this condition only suitable vehicle will be auto rickshaw because it is running within the urban area where low speed is recommended.

- When a vehicle is running, various resistances oppose it. In order to keep the vehicle moving at a uniform speed, a driving force or tractive effort equal to the sum of all the opposing forces has to be applied to it. If the tractive effort increases the total resistance affecting the movement of the vehicle, the excess tractive effort will accelerate the vehicle. If the tractive effort is less than the total resistances, the excess of the resistances will lower down the speed of the vehicle.

- Vehicle acceleration = Tractive effort – Total resistance affecting the movement of vehicle.

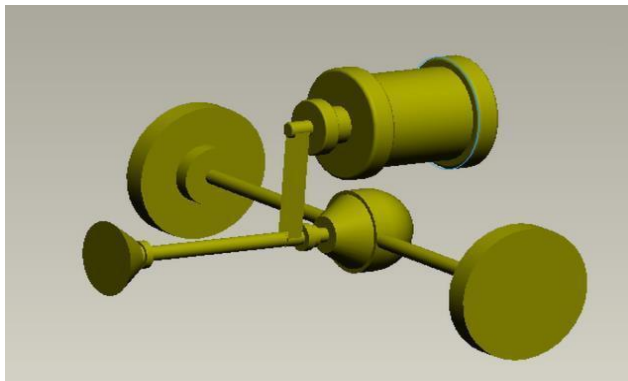


FIG 4: Hybrid transmission system

- In this series-parallel hybrid system is selected and to run this technology successfully, the solar energy is utilized in the maximum way with the help of calculations and as that the panel had been selected. From the panel used and the motor has powered, the backup source for the motor power is calculated. Finally, battery and controller are used.

- The vehicle would be designed with a new successful hybrid transmission system. The vehicle would be running with help of solar-electric power one to two hours per day. As a result of that the air and noise pollution would be reduced up to 30% in urban areas.

2.7 Solar Vehicle Changing the Future Lifestyle of Human

- Electric vehicle with more advantages of no noise, no pollution, saving energy and reduce carbon dioxide emissions is to power-driven vehicle with a motor drive wheels moving. Solar electric vehicle can make to reduce our greenhouse gas emissions and other pollution. All advantages of solar electric vehicle make research and application of solar electric vehicle as a “hot spot” of automotive industry and the trend of future cars. Solar electric vehicle is made of PV panels, battery, electric motor, vehicle controller and vehicle body. Solar electric vehicle drives using dual-mode of PV and battery hybrid. It can be achieved PV-driven and battery-driven independently.

- Solar electric vehicle project has been reported in which a Solar electric vehicle Kundi was developed by converting sunshine into electricity to realize green and clean transportation. Solar electric vehicle Kundi is driven using dual mode of PV and battery hybrid. It can be achieved PV-driven and battery-driven independently.

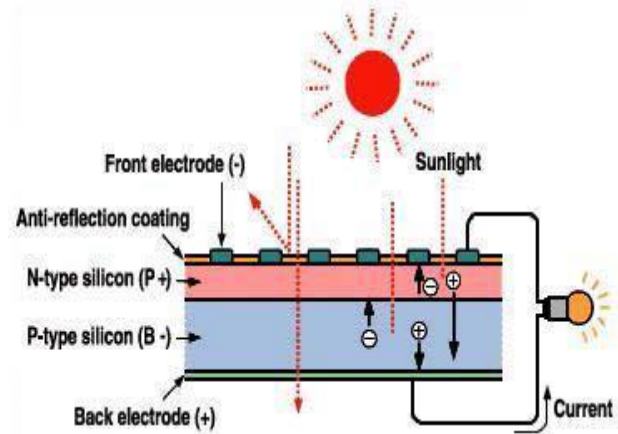


FIG 5: Dual-mode of PV and battery hybrid

3. Advantages and Disadvantages

Advantages:

- **Noise Free** – These electric rickshaws will be noise free and silent as compared to the normal auto rickshaws.
- **Pollution Free** – Since the electric rickshaws will use solar energy to run, they will be non polluting and will cut the carbon dioxide emissions in contrary to the normal auto rickshaws.
- **More Efficient** – The solar powered rickshaws will use 40% less energy than petrol auto rickshaw and hence will be more efficient.
- **Battery Life** – The solar powered rickshaw can run for ~60-70 kms after fully charged. According to a survey, auto rickshaws ply for 25-30 kms/ day in India.
- **Battery Charging** – The batteries of the solar powered rickshaws will need to be charged the whole night. Once charged it will meet the daily requirement of an average Indian rickshaw puller.
- **Battery Replacement Costs** – Will be reasonable, since the pricey petrol/ diesel, which is becoming increasingly unaffordable even by the rising middle classes in India.
- Capable of climbing up hill on an average inclination of 15deg to 30 deg.

Disadvantages:

- Solar vehicles don't have speed or power that regular vehicles have.
- Solar powered vehicles can operate only for limited distances is there is no sun.
- If it is dark out for many days, the vehicles battery will not charge and you this can seem as a problem



to many problem. This is the main reason why people don't rely on solar vehicles.

- A good solar powered vehicles is expensive.
- Parts used in solar vehicles are not produced in large quantity so they are expensive.
- The auto rickshaw cannot move as quickly as a car.

4. CONCLUSION

The conclusions drawn are the solar powered rickshaw can be a replacement for conventional auto rickshaw. The solar panel mounted above provides shade as well as power. For higher power, motor of higher capacity can be used. The parking place for solar powered vehicle does not require a shed. The ride is noise free, eco-friendly. The battery can be charged even during riding. This ensures continuous energy input to the vehicle without any additional cost. The vehicle run with the help of solar-electric power results in reducing the air and noise pollution up to 30% in urban areas.

5. REFERENCES

- [1] Solar Powered Rickshaw (SPR) can Diminish the Physical Labor of Rickshaw Puller Md Meganur Rhaman ; Tanvir Ahmed Toshon Assistant Professor, Department of Electrical and Electronic Engineering, Ahsanullah University of Science and Technology; 141-142 Love Road, Tegjaon, Dhaka, Bangladesh Tanvir Ahmed Toshon, 19/4/B Monipuri Para, Tejgaon Dhaka-1215, Bangladesh
- [2] Design and Development of Solar Electric Vehicles Rajat Sharma and Dr. J.P. Kesari Department of Mechanical Engineering, Delhi Technological University New Delhi, 110042, India
- [3] Comparative Study of Solar Rickshaw with Conventional Auto Rickshaw Rao M. Asif and Rizwan Ali Naqvi, Faculty Engineering and Technology Superior University Lahore Punjab Province, Pakistan asifrao37@yahoo.com
- [4] Performance Evaluation Of Solar Power Vehicle Rajendra Beedu Professor, Mechanical & Mfg Engineering, Manipal Institute of Technology, Manipal, India
- [5] Design Of Solar Powered Vehicle Prof. U.A .Athavankar, Rajat Shai Singh Industrial Design Center, IIT Mumbai
- [6] Fabrication of Solar Transport Vehicle V.Naveen Prabhu and N.Manigandan (M.E. Energy Engineering, SSN college of engineering, Chennai, Tamilnadu) (M.E. Energy Engineering, SSN college of engineering, Chennai, Tamilnadu)
- [7] 7. Solar Vehicle Changing the Future Lifestyle of Human Qingfeng Su, Genfa Zhang, Jianming Lai, Shijun

Feng and Weimin Shi Shanghai Lianfu New Energy S&T Co., Ltd., 1003 Wangqiao Road, Shanghai, 201201, China, qfsu@163.com

[8] Department of Electronics and Information Materials, Shanghai University, 149 Yanchang Road, Shanghai, 200072, China