

# Design and Fabrication of Solar Three Wheeler (Auto Rickshaw)

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**Abstract:** Automobiles working in now a days are either using petrol or diesel. A new trend has come in to existence in the form of electric vehicles by using Batteries. These vehicles are either costly or it will take time to manufacture as per our requirement. A thought process is evolved to convert the old auto into a green vehicle. Retrofitting of the existing diesel auto in to solar power based electric vehicle is a one solution to minimize pollution level. An attempt has been made retrofitting of the three wheeler in to solar power battery operated vehicle and working satisfactorily. This paper mainly concentrated on design and fabrication of solar three wheeler of the existing auto converted in to green vehicle. There is a wide scope for retrofitting of the existing three wheelers in to solar powered vehicles is possible without discarding the vehicles in to scrap yard.

**Keywords:** *Electric Vehicle, Green Energy, Retrofitting, Solar Energy*

## 1. Introduction

Renewable energy is energy that has been derived from earth's natural resources that are not finite or exhaustible, such as sunlight. Solar energy is derived by capturing radiant energy from sunlight and it is converted into either heat or as electricity. Photovoltaic system collects the light from the sun and turns it into electricity by using solar cells. Relying on solar energy rather than fossil fuels also helps us improve public health and environmental conditions. One of the benefits of solar energy is that sunlight is functionally endless. The solar electric three-wheeler intend to compeer and surpass the conventional vehicle's performance but with a more brilliant and efficient design. A solar rickshaw is a vehicle, usually three-wheeled, driven by an electric motor and powered either by solar panels or by a battery charged by solar

panels. Solar powered rickshaw raises the efficiency of the vehicle and solar panel increases its mileage by 20%. Auto Rickshaws are one of the chief modes of transport in many Asian countries. These vehicles are mainly used as taxis. Since there is heavy congestion on the roads, the small size and narrow body of this three wheeled vehicle is perfectly suited to navigate the roads. Rickshaw went through many evolutionary changes from the hand pulled rickshaw to cycle rickshaw to auto rickshaw to e rickshaw and now it reached to solar powered rickshaw. It is believed that it was first invented in Japan around 18th century and then it was used all around the globe.

## 2. Problem Statement:

Most of the cities in developing countries are highly polluted. The main reasons are air and noise pollution caused by transport vehicles, especially petrol-powered two and three wheelers. For example, in India there are 18 million petrol powered two wheelers and about 1.5 million petrol and diesel powered three wheelers. Their population is growing at a very high rate. In some cities rickshaw vehicles are the major means of transport. They provide employment to about 700,000 rickshaw pullers, and are very maneuverable and are completely non-polluting and hence environmentally friendly means of transport. Although the petroleum based vehicle design is well suited to the environment in which it operates, it is a crude and inefficient design. Due to poor vehicle maintenance and the use of inefficient two or four-stroke engines with very little. The solar/battery electric vehicles is meant to match and exceed the conventional vehicle's performance but with a more intelligent and efficient design. Research work on electric and solar vehicles around the world is in progress. Many are trying hard to make these vehicles as

alternative to petroleum based vehicles. Many of the researchers argue that the main reason for the air and Noise is petroleum based vehicles. It was found that Pollution from these vehicles is growing at a significant rate. Besides these vehicles recently solar three wheeler vehicle is being tried out which do not contain any pedal arrangement. So its driving speed is totally dependent on the charge of battery which diminishes gradually on use. When the batteries don't have enough charges these become inoperable. As a result, these require high motor and battery capacities that make them expensive. It was found that a recharging infrastructure is proposed for this rickshaw which will allow for the batteries to be charged using mostly renewable energy sources such as solar power and also consists of a central recharging station which supplies distribution points with charged batteries. Solar vehicle of three wheels is an upcoming model in Indian roads and transportation system. This solar vehicle stands for its flexibility and easily affordable.

### 3. Retrofitting of the Three Wheelers, Step by step Procedure

Retro vehicle from the market has been taken by us with a budget of minimum in which the final cost ranges from 55,000 to 65,000. Retro vehicle is made with the help of M.S(mild steel)chassis which has three wheels and a differential at rear wheels. Body is designed uniquely from passenger segment to load carriers. This vehicle has a capability to carry the weight ranging from 300kg to 400kg.solar vehicle working principle mainly involves a BLDC motor, battery and a solar panel. A BLDC motor has a capacity of 1KW with a differential mechanism at rear wheels. With the voltage of 48. The below sections explains the procedure adopted for retrofitting of the vehicle.



Fig: 1 Auto Procured from Market.

#### Step 1. Dismantling of the Old Vehicle:

First of all we are taking the old vehicle in to in our

workshop. We have removed the body frame and then engine removed from the vehicle. Fig. 2. Shows the dismantled vehicle and Engine from the existing old vehicle.



Fig: 2 Dismantled Parts

#### Step 2. Design of a Retro Fitting Vehicle.

Once the dismantling is over, we have prepared a Cad drawing for retrofitting of the vehicle. The design accustomed in our project is identical to a normal auto-rickshaw.

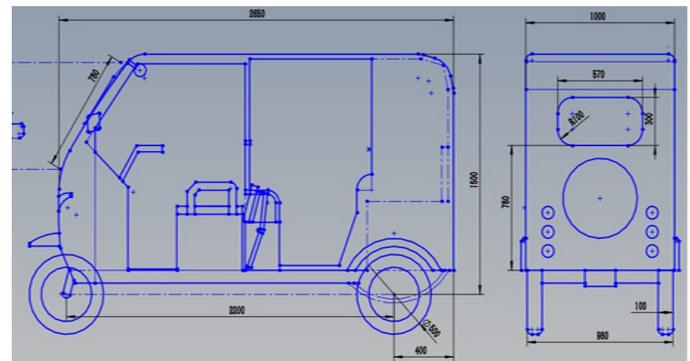


Fig 3.Design of auto-rickshaw

#### Step 3. Bought out. Parts and Components

According to our design the following are the bought components identified and procured.

- A) **Electric Motor:** Brush Less Direct Current (BLDC)

type 1KW &48V (Input) motor is used. It is controlled via motor controller.



Fig: 4 BLDC Motor

**B) Motor Controller:** This controller involves a manual or automatic switch which turns the motor on/off, forward or reverse motion, accelerating or decelerating as required, regulating or limiting torque for protecting against overloads. The motor controller first turns AC to DC and then turns DC back



Fig: 5 Motor Controller

**C) Battery:** As we require a voltage of 48 we have used a set of four 12v deep cycle lead acid batteries. These batteries are connected in series to the controller unit.



Fig: 6 Batteries

**D) Differential:** Differential is used in our project manufactured with M.S (mild steel), which is connected to the rear wheel and electric motor with the help of chain mechanism.



Fig: 7 Differentials

**E) Solar Panel:** In this project we require four solar panels of each 100w. The solar panel is manufactured by the company Akshaya solar power. The specification of solar panel is as below:

S.No	characteristic	Rated output
1	Maximum power	100W <sub>p</sub>
2	Open circuit voltage	22.30V
3	Short circuit current	6.30A
4	Voltage at max power	18.20V
5	Current at max power	5.51A
6	Series fuse rating	6A
7	Application class rating	Class A

TABLE 1 Specifications of the Solar Panel



Fig: 8 Solar panels

**F) Solar Charge Controller:** The solar charge controller is responsible for managing the power which goes to the battery bank from the solar array. It verifies that the deep cycle batteries are not overcharged in the day and the power generated doesn't run backwards to the solar panels overnight so that batteries are not drained out. It also holds some additional capabilities such as lightning and load control. PWM and MPPT are examples of solar

charge controller, which are neither similar in technology nor performance. In comparison of both the controllers the MPPT charge controller is high-priced than a PWM charge controller.



Fig: 9 Solar Charge Controller

**G) Circuit Diagram:**

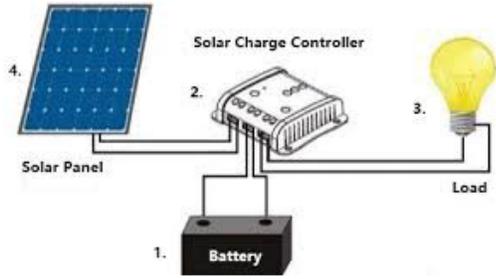


Fig: 10 Circuit Diagram

**4. Assembly Process**

Firstly we took the measurements of the vehicle required for our project followed by painting, we mainly used green color excessively to promote the concept of Go-Green. Secondly we adjusted the roof of the vehicle with the required material and fixed the four solar panels at a direction of 180°, lastly we joined the differential to the rear wheel with the help of arc welding. Fig 11 shows the various stages of assembly process.



Fig: 11 Assembly Process

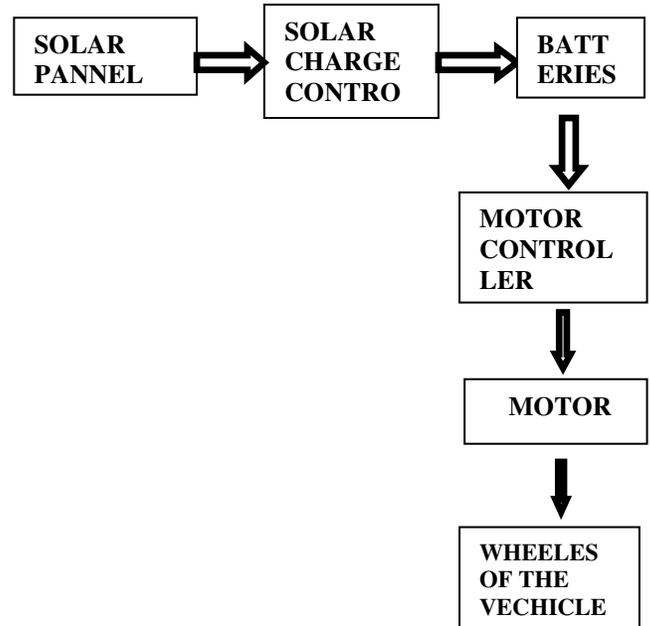


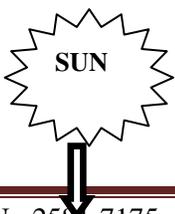
Fig.12. Schematic Diagram of the Vehicle

In our project we mainly used four solar panels of each 100W, which are aligned in the direction of 180° for boosting the capacity of the battery. When the sunrays fall on the solar panel the batteries get charged and the power moves from motor controller to motor which results in starting of motor with respect to accelerator. Fig 12 shows the final retrofitted vehicle. Fig 13 shows the schematic diagram of the vehicle.



Fig: 13 Final assembly

**5. Flow Diagram**



## 6. SPECIFICATION

**Table 2 Specification of the Vehicle**

COMPONENTS	DIMENSIONS
1.VEHICLE HEIGHT	1500MM
2.VEHICLE WIDTH	780MM
3.VEHICLE LENGTH	2600MM
4.GROUND CLEARNCE	500MM
5.WHEEL RADIUS	250MM
6.BATTERY	LEAD-ACID 48V,60AH
7.MOTOR	BLDC MOTOR 3-PHASE 48V,750W

## 5. Conclusion

We have successfully retrofitted old auto into green vehicle. The solar vehicle overcomes the problem of pollution and it is eco-friendly to the environment. The major advantage of using solar vehicle is it makes us free from the dependence of fossil fuels. Even though it has disadvantages like high price, small speed range and the rate of conversion of energy isn't convenient, we can easily make some changes by further research like using ultra efficient solar cells which gives about 30-35% of efficiency. The solar automobile has a huge prospective in market so that we can use it in our day to day life as per our requirements. The solar vehicle prepared in our project is running successfully with the help of solar power.

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