

# SOLAR POWERED ELECTRIC AUTO-RICKSHAW (SPEA)

## GANAPATI PRODUCTS

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# INTRODUCTION



**Promoting Climate Change Awareness Through Public Art**

**Battery operated electric three-wheelers or e-rickshaws have recently emerged in the public road transport sector in India.**

**The average specific energy consumption of the e-rickshaws has been found to be 53.76 kJ/passenger-km, which is the most efficient among other forms of motorized three-wheeled passenger vehicles.**

In India, majority of the passenger transport activities occur in the urban areas, suburbs, and townships.

In this transport mechanism, three-wheeled vehicles play the most important role as public, private and para-transit modes of transportation. Recently three-wheeled battery operated electric rickshaw or e-rickshaw has emerged in the public road transportation in West Bengal state in India, like many other parts of the country.

Along with the merits of such vehicles, there remain some technical, legal, and social challenges that hinder the pathway of proper implementation of such vehicles.

# INTRODUCTION



Test vehicle achieved a maximum speed of 21.69 km/h with battery discharge rate of 296W at 90 kg load and also reached a maximum discharge rate of 540W at 390 kg loading with a Maximum speed of 12.11 km/h.

The performance analysis of SPEA results in an optimal charging rate of 2 kWh per day with an average solar irradiance of 325 W/m<sup>2</sup> on a typical sunny day.

Charging EV using photovoltaic (PV) technology is up-and-coming due to a continuous decrease in the price of PV modules

Electric Vehicle or the battery operated vehicles are one of the newest clean technologies that is going to replace the vehicles running on the Petrol or diesel.

Few of the models which the manufacturers and research establishments are working on are as follows:

1. Swappable Power Bank
2. Solar application of vehicles rooftop
3. Solar Powered charging stations

# SWAPPABLE POWER BANKS



- India will soon embark on an ambitious programme aimed at switching most, if not all, of its vehicles to battery power by 2030. In an audacious move worthy of Elon Musk, the key to the plan's success will be the eschewing of subsidies driven by a battery leasing strategy. The scheme, which kicks off in the next few months, includes limited tax breaks for manufacturers and the sale of vehicles without batteries to improve affordability.
- The strategy is in marked contrast to the approach of most countries including the US, Japan and China, which have earmarked billions of dollars in subsidies for electric vehicles and have advised India against schemes that aren't funded this way. India, however, is forging ahead with its contrarian strategy that will start with public transport in the first phase.
- While Indian manufacturers are keen on being part of the initiative, most of the overseas ones favor hybrid technology.
- Two-wheelers, three-wheelers and non-air-conditioned city buses made by automobile companies in India will be sold without batteries as part of the plan, thus slashing prices by as much as 70%. The batteries will be leased at a specified cost and can be swiftly swapped with recharged ones at stations
- It will take just two-and-half minutes to replace auto batteries and can be done in 10 minutes when city buses rest after about a 30-km trip. The model, however, will not work for AC cars and AC buses.



# ROOFTOP SOLAR APPLICATION ON EV



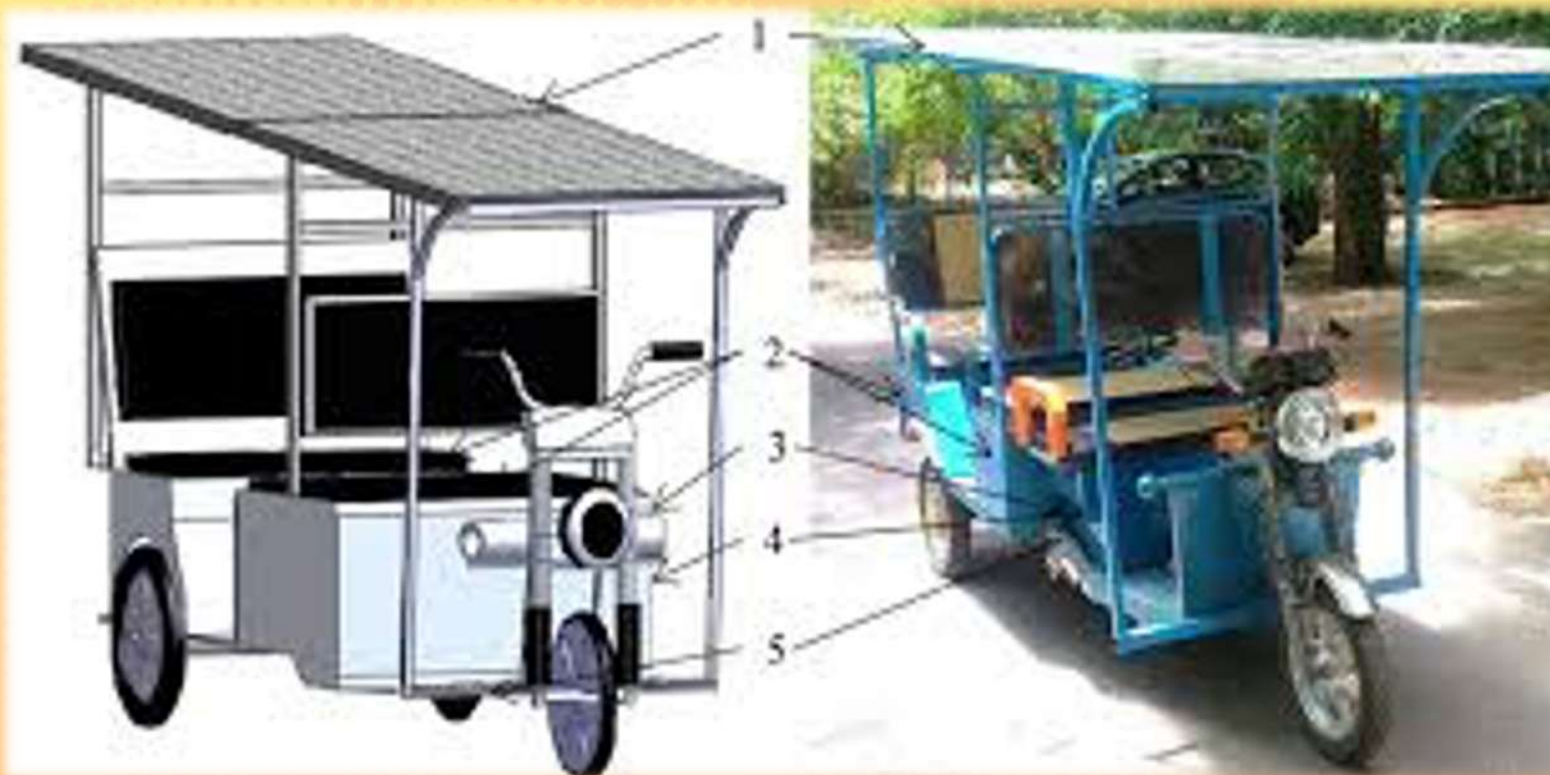
In our recent trial of placing the solar module on the TOTO (Electric Auto-rickshaw), we observed that the Totos were giving an additional run of up to 40 KM on a single charge when the solar modules were placed over the rooftop of the vehicles. During the non-sunny days the additional KMs were coming down to 7 KM.

Here are few photographs of the vehicles when the solar modules were placed over the rooftop.

Though the mounting was crude since it was only a research initiative, but the aesthetics and aerodynamics can be worked on. The key limitation that was found during the observations was the weight of the module along with mounting structure and second the Module voltage that was required is not readily available in the market.

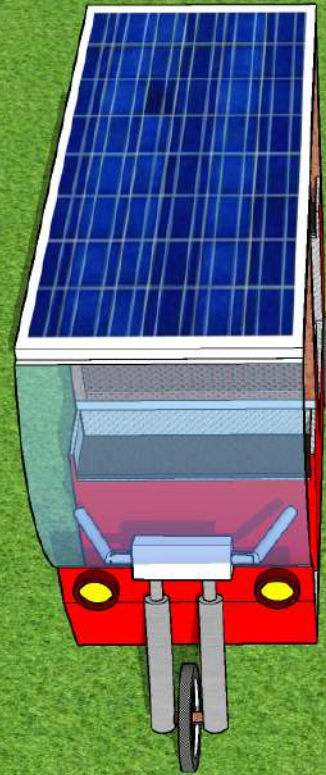


# PROTOTYPE





# DESIGN ARCHITECTURE



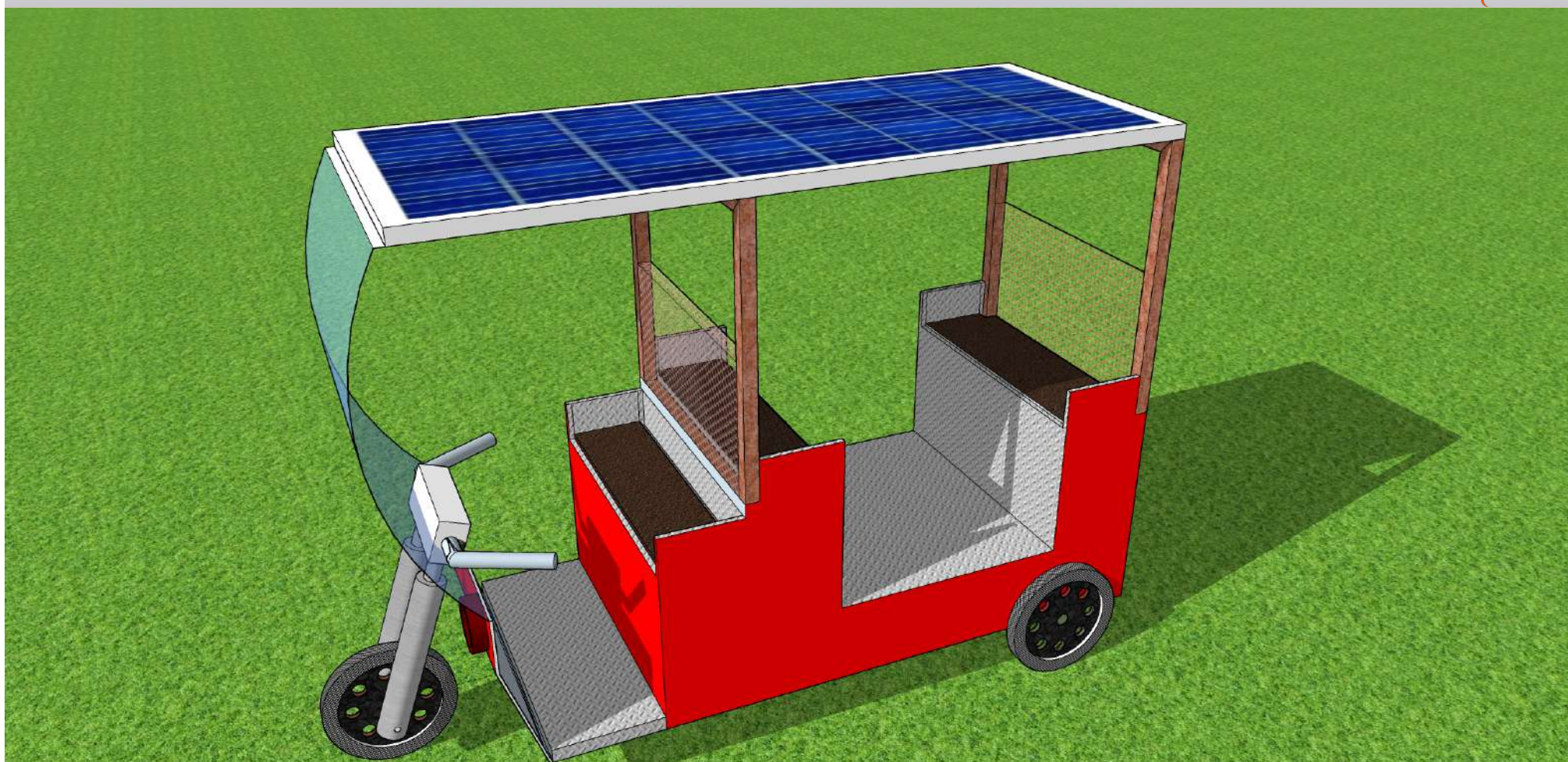


# DESIGN ARCHITECTURE



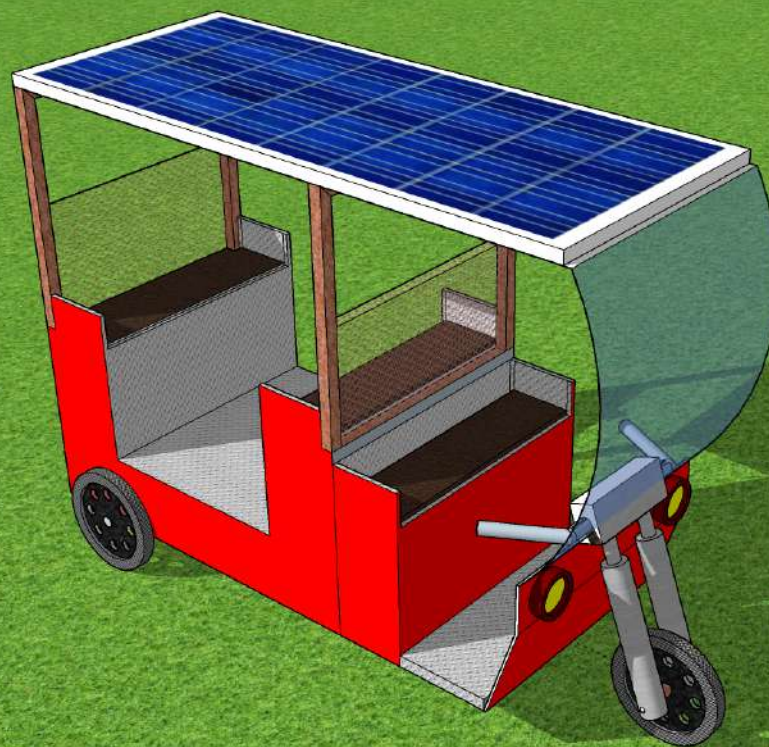


# DESIGN ARCHITECTURE





# DESIGN ARCHITECTURE





# MAJOR COMPONENTS INVOLVED



|                              | MODEL     | MATRIX | NO. OF CELLS | MODULE SIZE (L X W X H) |     |    | CTC VERTICAL | CTC HORIZONTAL | MOUNTING HOLE | WEIGHT (kg) | Voc   | Isc   | Vmp   | Imp  | Pmax | MOD. EFF ( % ) | FF ( % ) |
|------------------------------|-----------|--------|--------------|-------------------------|-----|----|--------------|----------------|---------------|-------------|-------|-------|-------|------|------|----------------|----------|
| MULTI CRYSTALLINE<br>72 CELL | SS34072MC | 6 X 12 | 72           | 1961                    | 991 | 40 | 978          | 943            | 8 X 10        | 21.3        | 46.56 | 9.48  | 37.01 | 9.20 | 340  | 17.50          | 77       |
|                              | SS33572MC | 6 X 12 | 72           | 1961                    | 991 | 40 | 978          | 943            | 8 X 10        | 21.3        | 46.42 | 9.41  | 36.87 | 9.10 | 335  | 17.24          | 77       |
|                              | SS33072MC | 6 X 12 | 72           | 1961                    | 991 | 40 | 978          | 943            | 8 X 10        | 21.3        | 46.31 | 9.30  | 36.77 | 8.98 | 330  | 16.98          | 77       |
|                              | SS32572MC | 6 X 12 | 72           | 1961                    | 991 | 40 | 978          | 943            | 8 X 10        | 21.3        | 46.15 | 9.21  | 36.68 | 8.87 | 325  | 16.72          | 77       |
|                              | SS32072MC | 6 X 12 | 72           | 1961                    | 991 | 40 | 978          | 943            | 8 X 10        | 21.3        | 45.92 | 9.12  | 36.58 | 8.76 | 320  | 16.47          | 77       |
|                              |           |        |              |                         |     |    |              |                |               |             |       |       |       |      |      |                |          |
| MONO PERC<br>72 CELL         | SS38572MP | 6 X 12 | 72           | 1961                    | 991 | 40 | 978          | 943            | 8 X 10        | 21.3        | 47.72 | 10.02 | 40.59 | 9.49 | 385  | 19.81          | 81       |
|                              | SS38072MP | 6 X 12 | 72           | 1961                    | 991 | 40 | 978          | 943            | 8 X 10        | 21.3        | 47.65 | 9.98  | 40.39 | 9.43 | 380  | 19.55          | 80       |
|                              | SS37572MP | 6 X 12 | 72           | 1961                    | 991 | 40 | 978          | 943            | 8 X 10        | 21.3        | 47.52 | 9.92  | 40.19 | 9.34 | 375  | 19.30          | 80       |
|                              | SS37072MP | 6 X 12 | 72           | 1961                    | 991 | 40 | 978          | 943            | 8 X 10        | 21.3        | 47.37 | 9.87  | 39.96 | 9.27 | 370  | 19.04          | 79       |
|                              | SS36572MP | 6 X 12 | 72           | 1961                    | 991 | 40 | 978          | 943            | 8 X 10        | 21.3        | 47.26 | 9.81  | 39.77 | 9.18 | 365  | 18.78          | 79       |



# PROJECT FINANCIALS



| SL. NO.                                       | SPECIFICATIONS         |  |
|---|------------------------|--|
| 01.   | SOLAR MODULE           | 370 WP, 48 V                                   |
| 02.   | MOUNTING STRUCTURE     | Aluminum / GI                                  |
| 03.   | MPPT CHARGE CONTROLLER | 24V 20AMPS / 30AMPS                            |
| 04.   | CABLE & ACCESSORIES    | DC CABLES, AC CABLES, CONSUMABLES, MISC. ITEMS |
| <b>TOTAL (EXCL. GST &amp; TRANSPORTATION)</b> |                        | <b>₹ 25,640</b>                                |



# COST OF CHARGING:



| SL. NO. | SPECIFICATIONS                  | REMARKS      |
|---------|---------------------------------|--------------|
| 01.     | Power Consumed in single Charge | 4 kWh        |
| 02.     | Electricity Tariff              | ₹ 8 / kWh    |
| 03.     | No. of charge Daily             | 2 nos        |
| 04.     | Total Cost of charging per day  | ₹ 64/-       |
| 05.     | Average KM daily                | 70 KM        |
| 06.     | Cost per KM                     | ₹ 0.914 / Km |

# FEASIBILITY OF SOLARISATION:



| SPECIFICATIONS                      | REMARKS    |
|-------------------------------------|------------|
| Average extra KM after Solarization | 40 KM      |
| Cost saved per day                  | 36.57 INR  |
| Annual Savings                      | 13,349 INR |
| Payback                             | 2 Years    |





Contact Us

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