# Design Analysis and Fabrication Of Solekshaw

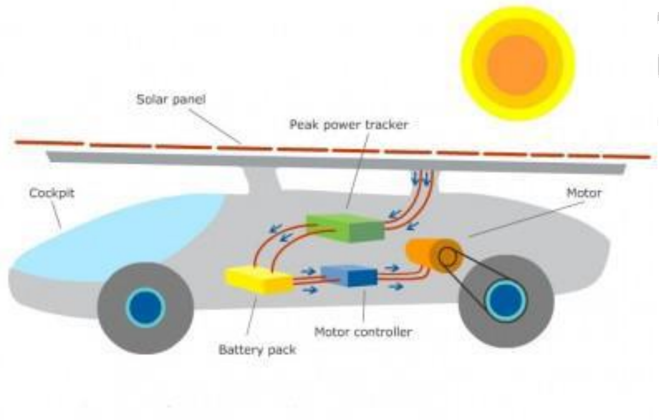
N.Harini
*Assistant Professor, Department of Mechanical Engineering,*
*KG Reddy College of Engineering and Technology, Moinabad, Telanagana, India*

***Abstract:*** SOLEKSHAW indicates the meaning as SOLAR-ELECTRIC-AUTO RICKSHAW. In the busy streets of cities, mainly in Asian subcontinent, we find many tricycles and auto rickshaws. Auto rickshaws are driven by fossil fuel, which produces too much environment pollution. On the other hand tricycles or cycle rickshaws are used to carry two no of passengers and suitable for narrow streets at a speed below 20 Km/hr. Since it is not using any kind of fossil fuel, it is free from environmental pollution. But it is driven fully by manual power, which is a very strenuous job for driver. Now-a-days considering the climatic changes caused by environmental pollution, introduction of green vehicles has become very important. Especially in busy streets of cities, pollution is at alarmingly high levels due to very slow movement of automotive vehicles. Keeping this in mind, introduction of **Solar Powered Motor assisted pedicab** has been thought to be a wise prerogative, mainly in the busy and narrow streets of cities.

***Keywords:*** *Tricycle, Auto rickshaw, pedicab, Photo-voltaic, Reliable, Light-pipes, Transmission system, DC Motor*

## I. INTRODUCTION

The three-wheeled cycle rickshaw (or pedicab) has been developed of which rear wheels are driven by manual power and front wheel is driven by Brush Less DC (BLDC) electric hub motor. Electric motor is powered by lead acid battery source. The battery is charged at a solar power charging station during off time. This vehicle provides driving comfort to the driver due to addition of electric motor. These pedicabs can run for longer distances compared to present manual
Driven cycle rickshaws, resulting in more earning of rickshaw pullers. The motor power has been imparted at front wheel and manual power on the rear wheel to achieve simple transmission system. The BLDC hub motor is a traction type motor, which can supply high torque at low speed and low torque at high speed. This interesting characteristic of motor eliminates the use of any gear train, results in simple and light transmission system. An override mechanism has been used at the center of rear axle, resulting in proper turning and better dynamic stability of the vehicle. The braking system is introduced in all three wheels for proper stability and safety. Its power source is Solar Energy, which eliminates the problem of environmental pollution that happens with normal auto rickshaw. The battery is charged from solar charging stations by battery swapping mechanism and no need of any overhead solar panel, which reduces the weight and cost of vehicle.

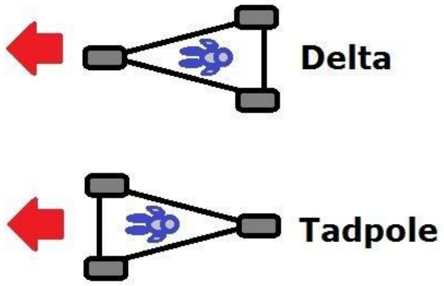



## SELECTION OF VEHICLE

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 **Selection of hybrid technology** after the view of all the following types parallel, series and series-parallel hybrid system. It infers that all the types of technology suits well for some particular purposes, for this project series-parallel hybrid technology is better and it is well suited. Because with this technology the fuel usage and the speed limit can be maintained well in the city limits as well as speed and heavy loads carryings can be attained outer of the city limits with less fuel consumption.

**THREE WHEELED VEHICLE DESIGN**

**Delta:** One wheel in front, two in back.
**Tadpole:** Two wheels in front, one in back.




**DYNAMIC STABILITY**

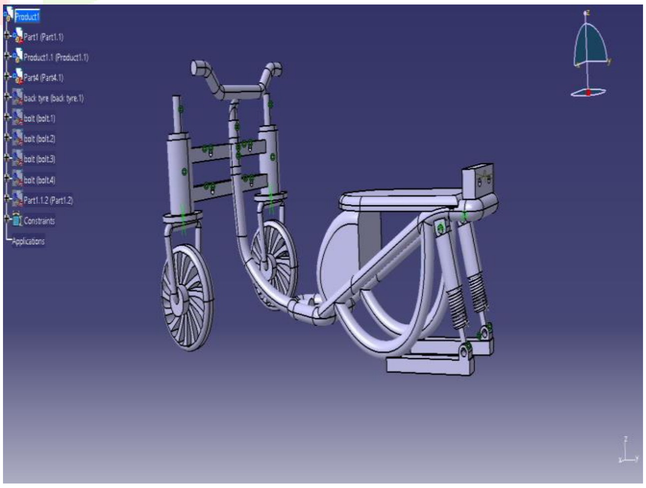
When a vehicle is said to be dynamically stable it is meant that it reacts safely and predictably under various driving conditions. When designing a chassis, we can choose how the car will react when turning too fast. One of two things will always happen: either the car wheels will slip relative to the ground, or the vehicle will tip over. Obviously, slipping is the desired outcome. Keep this in mind for the moment.

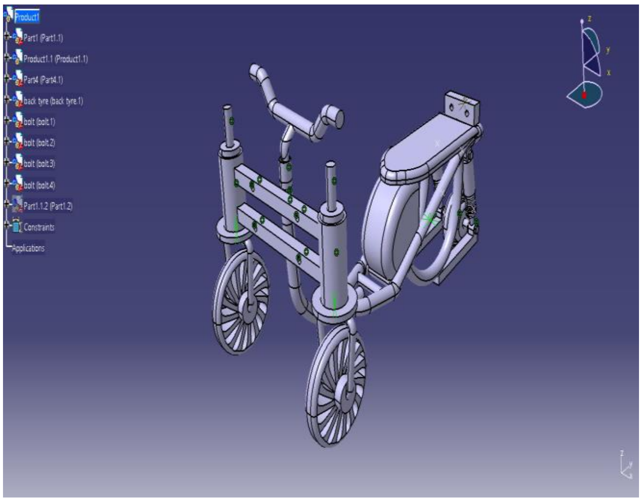
When the car does slip out of control on a fast turn, we can design it in such a way that we know whether the front or rear wheels will slip first. This is important because if the rear wheels slip first, the vehicle runs the risk of spinning out of control (oversteer). If the front wheels slip first (under steer), you won't spin out and it is easier to regain control. Understeer is considered a safe dynamic response to slipping in a turn and is designed into all commercial cars. Which wheels will slip first is a simple matter of weight distribution and weight transfer. The problem for delta vehicles is how to distribute their weight and control their weight transfer during a turn to avoid undesirable outcomes. If you design the weight distribution for a heavy front bias to achieve under steer, you increase the risk of tipping over. If you increase the weight distribution on the rear tires, the vehicle will oversteer in hard turns.

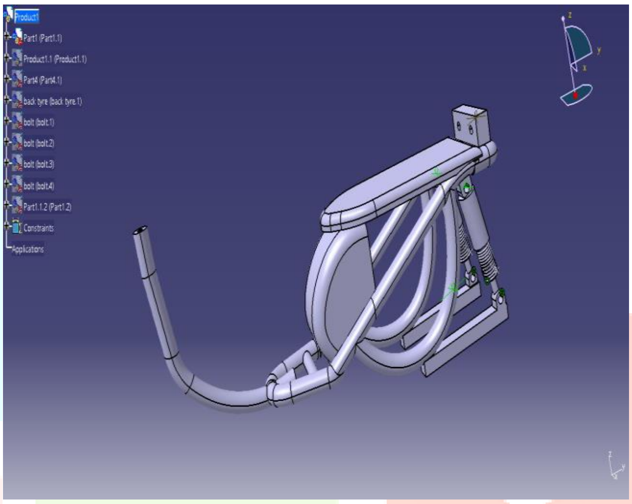
We also need to consider nose diving, which is exactly what it sounds like. When you slam on the brakes as hard as possible, the vehicle will either skid to a halt or the rear wheels will lift off the ground. This is also a function of weight distribution and weight transfer. It would seem that the delta design has an advantage here because it naturally lends itself to having a rear biased weight distribution. But in the real world, a hard stop doesn't always occur when traveling in a straight line. If you stop hard enough while turning with a delta vehicle, the weight will transfer to the front wheel enough (despite suspension designs to prevent this) to cause the vehicle to flip over at an angle.

Category Winner: Tadpole

**VIEWS OF THE SOLEKSHAW**







**Various parameters of our chassis are as shown:**

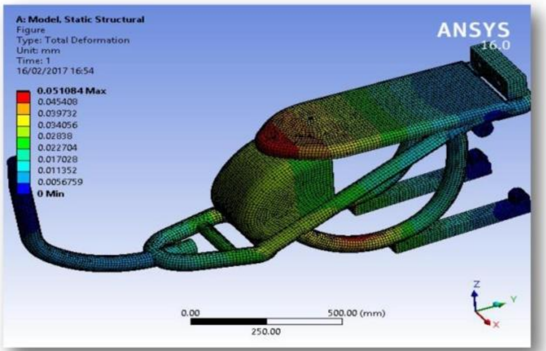
| | |
|---|---|
| Mass of the chassis | 65kg |

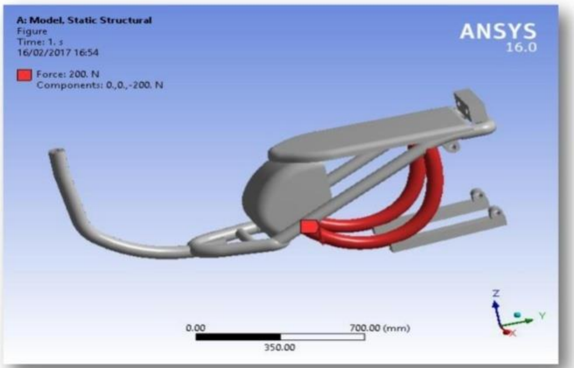
| | |
|---|---|
| First Saved | Wednesday, February 8, 2017 |
| Last Saved | Thursday, February 16, 2017 |
| Product Version | 16.0 Release |
| Imported Source | C:\Users\BSP\Desktop\LIVE PROJECTS REGISTERED 2017\1 FABRICATION OF SOLEKSHAW (K.G REDDY)\ansys\chasis cast iron.mechdat |
| Imported Version | 16.0 Release |
| Save Project Before Solution | No |
| Save Project After Solution | No |

| | |
|---|---|
| Object Name | *Geometry* |
| State | Fully Defined |
| **Definition** | |
| Source | C:\Users\BSP\AppData\Local\Temp\WB_BSP302_BSP_5932_2\unsaved_project_files\dp0\SYS-1\DM\SYS-1.agdb |
| Type | Design Modeler |
| Length Unit | Meters |

| | |
|---|---|
| Element Control | Program Controlled |
| Display Style | Body Color |
| **Bounding Box** | |
| Length X | 380. mm |
| Length Y | 1867.5 mm |
| Length Z | 855.57 mm |
| **Properties** | |
| Volume | 2.7842e+006 mm³ |
| Mass | 20.047 kg |
| Surface Area(approx.) | 2.7842e+006 mm² |
| Scale Factor Value | 1. |

By making the wheels as fixed points, major loads (such as engine and driver weight) are applied on chassis




- Force applied on Chassis = 200 N (45kg on driver's place + 20kg engine) + weight of chassis.
- Factor of safety was evolved as 1.57 which is well within the limits.

**SPECIFICATION OF SOLEKSHAW**

**Dimension of Solekshaw**

| S no. | Parameter | Value(mm) |
|---|---|---|
| 1. | Length | **1720** |
| 2. | Height | **1880** |
| 3. | Width | **1050** |
| 4. | Clearance | **110** |
| 5. | Roof shed size | **1270** |
| 6. | Weight | **65kg** |
| 7. | Battery | **12V (four battery)** |

| | | |
|---|---|---|
| 8. | Brake type | **Drum brake** |
| 9. | Daily distance driven | **25km** |

**Specification of Motor used**

| S no. | Parameter | Value |
|---|---|---|
| 1. | Wheelbase | **1300** |
| 2. | Weight | **8.80kgs** |
| 3. | Displacement | **34** |
| 4. | Max power | **800W** |
| 5. | Max torque | **9.68N.m** |
| 6. | Max voltage output with alternator | **48V** |

**Solar panel specification**

| S no. | Parameter | Value |
|---|---|---|
| 1 | Power output | **80W** |
| 2 | Voltage at P max | 17.5V |
| 3 | Current at P max | 4.58A |
| 4 | Open circuit voltage | 21.5V |
| 5 | Short circuit current | 5.1V |

**MOTOR TORQUE CALCULATION**

Factors Affecting the Required Torque

When selecting drive motor for the electric vehicle, a number of factors must be taken into account to determine the maximum torque required.

These factors are:

1. Rolling resistance
2. Grade resistance
3. Acceleration force

**ROLLING RESISTANCE**

GR =GVW □sin□

GR □ Grade Resistance

□ □ Grade or inclination angle

Here angle varies so taking an average inclination of $25^0$ GR=6.3765□sin (25)

=2.69

**ACCELERATION FORCE**

FA= m □a

m =GVW/ g

FA □ Acceleration force

m □ mass of the vehicle

g □ acceleration due to gravity( 9.81 / sec m )

a □ required acceleration

FA=65 □ 9.45

=614

**FINDING THE TOTAL TRACTIVE EFFORT**

TTE =RR□FA□GR

TTE=623.06

TTE □ Total tractive effort

**TORQUE REQUIRED ON THE DRIVE WHEEL**

The torque that is required on the drive wheel will be the one that the drive motor requires to produce so as to obtain the desired drive characteristics.

The torque is:

□□ Rf □ TTE □ rwheel

□□ Torque

Rf □ Friction factor that account for frictional losses between bearings, axles etc Rwheel □ radius of drive wheel

**BATTERY CALCULATION**

The system uses four battery each of 12V, 18Ah. Assuming the depth of discharge (DOD) of a battery is 70%.the vehicle consume battery energy 864Wh and it could cover 80km in 4hours. So, the vehicle consume 220W to covered 20km in an hour. The power consumption calculation is given below:

Battery capacity=18Ah

Battery voltage=12V

Total energy storage capacity=18*12*4=864Wh

Battery depth of discharge=70%

Use battery capacity=18Ah*70%=15Ah

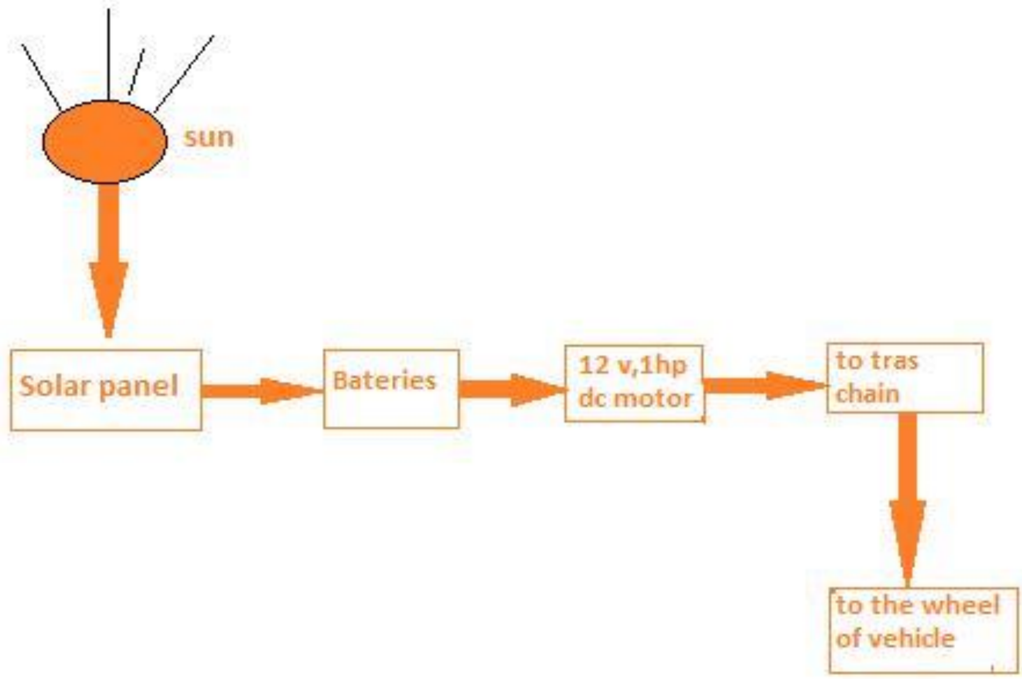
Total usable vehicle covered per day=80km

Total driving time=6h

Vehicle Consume power per hour =864/4=217W

Distance covered in an hour=80km/4=20km

**POWER TRANSMISSION FIGURES ANIMATED FIGURES**




**CONCLUSION:**

The dual-powered Soleckshaw is the CSIR's solution for the dual problem of better life to Rickshaw puller and mitigation of global warming. More than 60% of the increase in the greenhouse gas (GHG) emission is from the transport sector. With better aesthetics and ergonomics, the cost effectiveness of Soleckshaw has been engineered by optimizing the system around the most appropriate commercially available components. This would also minimize the capital requirement for a mass manufacturing unit. Only the novel sub-assemblies like the differential drive, the special hub motor and the light weight solar panel at low cost need to be manufactured apart from the chassis designed for comfortable ride even for the senior citizens and physically challenged.

It described in the text to be followed which have been utilized or to be utilized in the nearby the future.

**REFERENCES:**

**Brief Solar Energy Background**

"Department of Energy - Solar." *Department of Energy*

"Solar Electricity." Solar Direct.

"Clean Energy." *EPA*. Environmental Protection Agency.

**Scope of Improvement**

"Clean Energy." *EPA*. Environmental Protection Agency

"U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." *U.S. Energy Information Administration (EIA*

**Introduction to a Solar Tracker**

Roberts, Jeanne. "Tracking Systems Vital to Solar Success." *Solar Energy*.
"Department of Energy - Solar." *Department of Energy*
Starr, Robert J. "Solar Energy and the Environment." *Solar Radiant*.

http://www.altenergy.org/renewables/solar/latest-solar-technology.html
mericansolarchallenge.org

https://en.wikipedia.org/wiki/Solar_car

www.juwi.com/solar-energy