DESIGN,ANALYSIS AND MANUFARTURING OF NEW TECHNOLOGY SOLAR CAR

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Abstract - *The main aim of the solar car is to create a eco friendly vehicle with the help of solar energy. Initially solar panels are used as a source of power to charge the batteries in addition to that SELF POWER GENERATION SYSTEM and THERMO-ELECTRICAL POWER GENERATION SYSTEM are also used as an alternate sources to charge the batteries. These systems help to run the vehicle during the absence of solar power. The vehicle is given Aero dynamic design which increases the efficiency of the vehicle to a certain extent. Mechanical Actuation System is provided in the vehicle which works in a sliding mechanism i.e the solar panels slides outwards during the charging period and slides inwards during the driving of the vehicle. This system allows to create more surface area for charging when the panels slides outwards and when the panels slides inwards it gets placed in an Aero dynamic position hence increasing the efficiency of the vehicle. A differential gear box set up is made according to the required power , speed and torque using helical gears. The Thermo-electric power generation system made up by bismusth telloriode , a semi conductor generates e.m.f using the temperature difference in the vehicle. A reliable innovative frame structure is used which can with stand any speed, temperature and weight and doesn't fail under any circumstances*

***Key Words*: Solar panels ,Self Power Generation, Thermo-Electrical, Aero dynamic, Mechanical Actuation Bismusth Telloriode, etc**

1. INTRODUCTION

These systems help to run the vehicle during the absence of solar power. The vehicle is given Aero dynamic design which increases the efficiency of the vehicle to a certain extent. Mechanical Actuation System is provided in the vehicle which works in a sliding mechanism i.e the solar panels slides outwards during the charging period and slides inwards during the driving of the vehicle. This system allows to create more surface area for charging when the panels slides outwards and when the panels slides inwards it gets placed in an Aero dynamic position hence increasing the efficiency of the vehicle. A differential gear box set up is made according to the required power , speed and torque using helical gears. The Thermo-electric power generation system made up by bismusth telloriode , a semi conductor generates e.m.f using the temperature difference in the vehicle. A reliable innovative frame structure is used which can with stand any speed, temperature and weight and doesn't fail under any circumstances

1.1 Importance of SOLAR ENERGY

Solar energy is an important part of life and has been since the beginning of time. Increasingly, man is learning how to harness this important resource and use it to replace traditional energy sources

1.2 Solar Energy Is Important as Clean Energy

Since solar energy is completely natural, it is considered a clean energy source. It does not disrupt the environment or create a threat to Eco-systems the way oil and some other energy sources might. It does not cause greenhouse gases, air or water pollution. The small amount of impact it does have on the environment is usually from the chemicals and solvents that are used during the manufacture of the photovoltaic cells that are needed to convert the sun's energy into electricity. This is a small problem compared to the huge impact that one oil spill can have on the environment

1.3 Solar Energy Is Versatile

Solar energy cells can be used to produce the power for a calculator or awatch. They can also be used to produce enough power to run an entire city.With that kind of versatility, it is a great energy source. Some of the ways solarenergy is being used today

2. Need for Solar Cars

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 suns 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.

Solar vehicles are not sold as practical day-to-day transportation devices at present, but are primarily demonstration vehicles and engineering exercises, often sponsored by government agencies. However, indirectly solar-charged vehicles are widespread and solar boats are available commercially.

2.1Solar cars

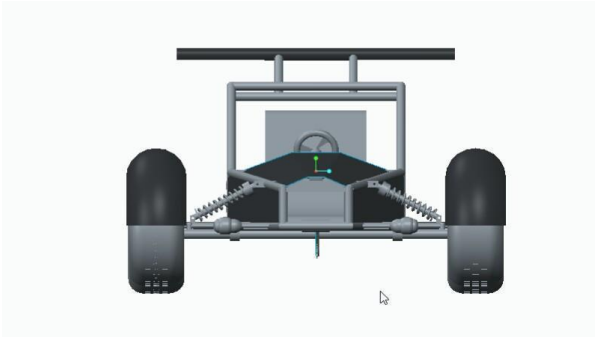
Solar cars depend on PV cells to convert sunlight into electricity to drive electric motors. Unlike solar thermal

energy which converts solar energy to heat, PV cells directly convert sunlight into electricity.

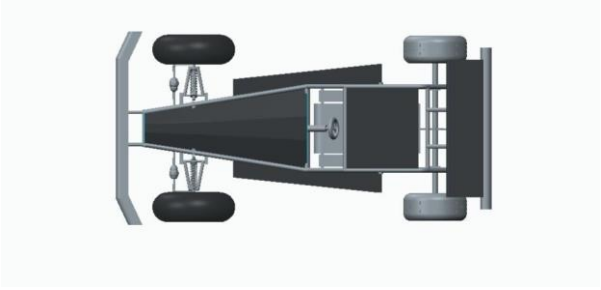
Solar cars combine technology typically used in the aerospace, bicycle, alternativeenergy and automotive industries. The design of a solar car is severely limited by the amount of energy input into the car. Solar cars are built for solar car races. Even the best solar cells can only collect limited power and energy over the area of a car's surface. This limits solar cars to ultralight composite bodies to save weight. Solar cars lack the safety and convenience features of conventional vehicles.Solar cars are often fitted with gauges and/or wireless telemetry, to carefully monitor the car's energy consumption, solar energy capture and other parameters. Wireless telemetry is typically preferred as it frees the driver to concentrate on driving, which can be dangerous in such a small, lightweight car. The Solar Electric Vehicle system was designed and engineered as an easy to install (2 to 3 hours) integrated accessory system with a custom molded low profile solar module, supplemental battery pack and a proven charge controlling system.As an alternative, a battery-powered electric vehicle may use a solar array to recharge; the array may be connected to the general electrical distribution grid.

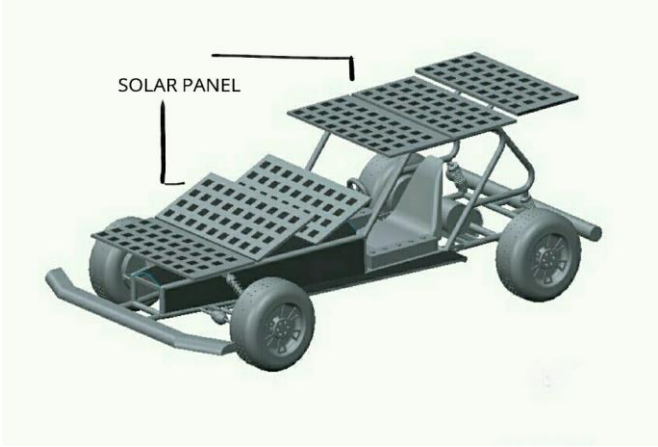
DESIGN

a)Front View



b)TOP View

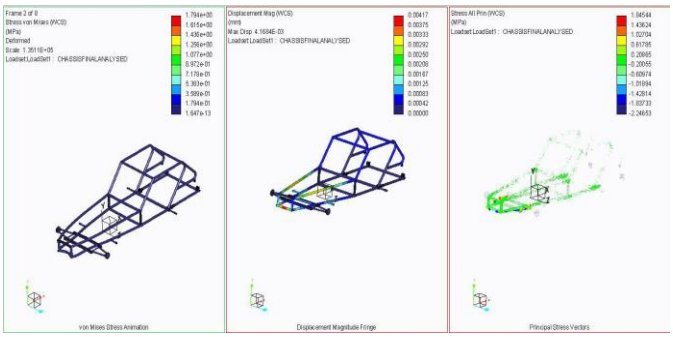




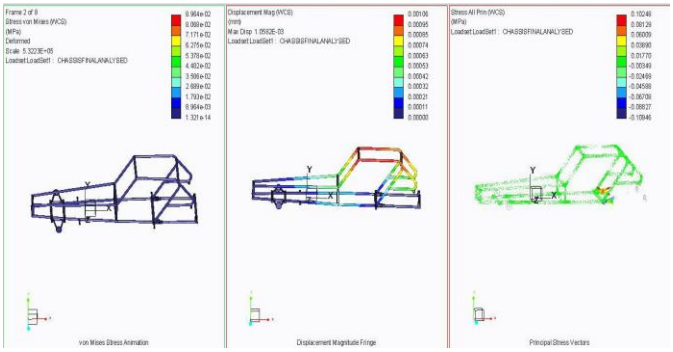
c) Design with solar panel

Analysis of chassis

a.Front impact test



b.Side impact test



3. INNOVATION

1)Self Power Generating System
2)Electromechanical Braking System
3) Innovativeairo dynamics(Convertible)
4)Steering Mechanism
5)Thermo Electric Power Production System
6) Ecu

3.1 SELF POWER GENERATION SYSTEM

The self-power generating system is introduced in the vehicle to produce the power supply for charging the battery continuously by getting the minimum mechanical energy as an input.

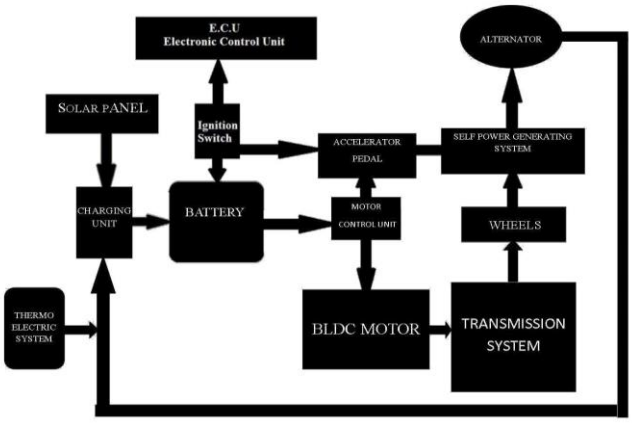
Primary design:-

this is achieved by introducing the new system which is named as a self-power generation system . in this system there are three main parts for increasing the efficiency of the unit . the first one is a step up helical gear box with the speed ratio of 1:10 . then the second one is a sprocket arrangement which is having a transmission ratio of 1:2 . finally the new and hi-tech setup placed as the third one is called planetry gear box. This was considered as a main system in this design the transmission ratio of this sytem is 1:3 . therefore the total speed ratio which is achieved in this design is about 1:60 . final output is transmitted to the alternator for getting the maximum power output

Secondary design:-

The secondary design is nothing but having the similar parts which is available in primary design except the planetary gear box . here on considering the drawbacks which was occurred because of using the planetry gear box is confirmed by doing the test drive on road with the whole setup of the vehicle . atlast the sustainability of the system is not upto the level therefore the primary design is modified into secondary design.

Block diagram of SPG



1.Calculation:

SPG calculation =1+R S (1+ ring/sun)
=1+ (100/44)
=3.4

Therefore Ratio is 1:3.4

Planetary gearbox calculation

$N_R=N_S+2N_P$

100=44+(2*28)

100=44+56

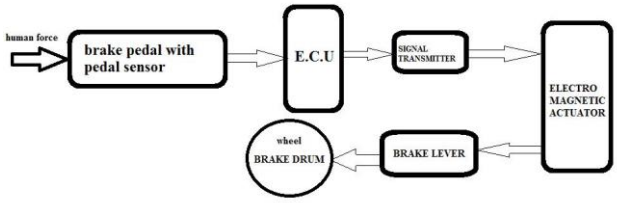
100=100

That is to say, the number of teeth in the ring gear is equal to the number of teeth in the middle sun gear plus twice the number of teeth in the planet gears.

3.2OBJECTIVE OF THE BREAK SYSTEM

The present invention will now be described in further detail.The main advantage of the invention can be seen in the fact that the brake system represents an exclusively electromechanical brake system, i.e., a brake system that does not contain an additional hydraulic or mechanical brake circuit. This brake system makes it possible to reliably decelerate the motor vehicle with a certain number of braking activations even if the on-board network malfunctions or fails. This is ensured by the brake circuit, that can use the emergency power storage mechanism until it is depleted. The motor vehicle can also be safely parked because the other emergency power storage mechanism, which supplies the other brake circuit, always contains sufficient residual power.

Block diagram



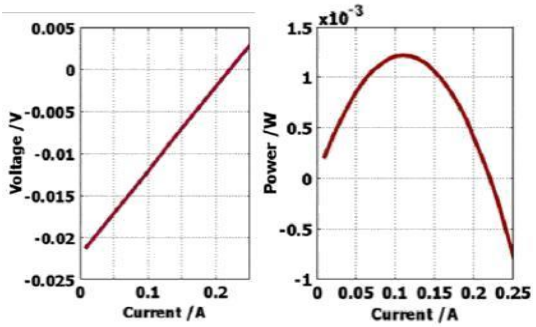
3.2 STEERING MECHANISM

We are using our own design in the steering system Instead of using the existing rack and pinion gear box. We are using the rack and pinion in a different form for turning the wheels

1.Steering ,2.shaft rack ,3.pinion shaft ,4.nuckle joint, 5.wheel drive

3.4)Thermo Electric Power Production System

In this presentation an implementation of thermoelectric effects in comsol multiphysics is described using the pde-application mode. therefore the coupled heat equation and poisson's equation are extended by the thermoelectric effects and solved simultaneously, to get the solution for the field variables temperature t and voltage v:



Graph 1: Production system

Current-voltage (left) and current-power characteristics (right) for the upper thermoelectric element

3.5 ECU

This is a most important one which is going to control the entire car by controlling, regulating, analyzing the working of some systems and intimating some terms to the drivers.

3.6 POWER SAVE MODE:

We installed the innovative mode setup for saving the power by reducing the current discharge rate from the battery.

Specification of motor

Power	=1000W
Operating Voltage	=60V

Battery Specification

Voltage	=12V
Capacity	=24AH
Quantity	=5

Solar Panel Specification

Power	=100W
Open Circuit Voltage	=21.84V
Short Circuit Current	=6.11A
Voltage at maximum power	=17.99V
Current at maximum power	=5.57A

How much energy will motor consume for a period of time?

Energy consumed by motor in 3 hrs. =1000x
Time =1000 x 3 =3000WH

How much energy solar panel will generate over a period of time?

Energy produced by solar panel for 3 hrs.
=Power x Time =3000WH

Discharging time of battery (considering battery to be fully charged)

How much energy can battery store

Energy Stored in battery =Capacity x Voltage
=24x60
=1440WH

Discharging time (with power loss of about 25%)
=1.44 x (75/100)
=1.08hrs
=1.08hour

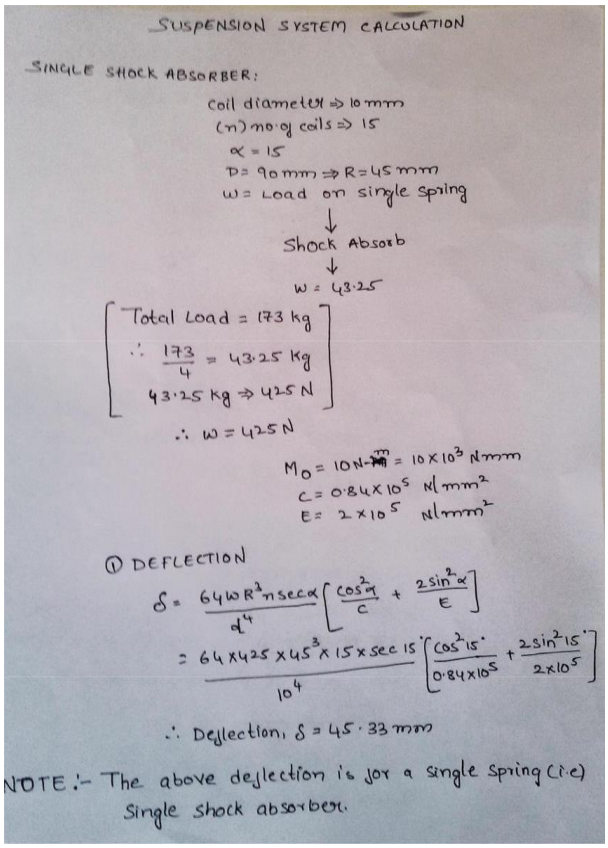
4. PRINCIPLE OF WORKING

We claim:

1. A method for operating an electromechanical brake system of a motor vehicle that contains the following components:brake actuators, one assigned to each wheel of the motor vehicle, a control unit for controlling or regulating the brake system, and a first and second brake circuit that operate independently of one another and are supplied with power by an on-board network of the motor vehicle in the normal mode, said method comprising: monitoring the voltage of an on-board network in a control unit, wherein the electromechanical brake system operates in a normal mode if the voltage of the on-board network exceeds a predetermined value, and wherein the brake system operates in the emergency mode if the voltage of the on-board network voltage falls below a predetermined value, operating both brake circuits if the brake system is actuated in the normal mode, with the proviso that if the brake system is actuated in the emergency mode, only the first one of the two brake circuits can be actuated until an emergency power storage mechanism assigned to the first brake circuit is depleted, where in only the second brake circuit is operated until the emergency power storage mechanism assigned to the second brake circuit has reached a residual power value that is sufficient for locking the wheels the second brake circuit at least once while the motor vehicle is at a standstill.

2.The method for operating an electromechanical brake system according to claim **1**, further comprising in the emergency mode of the brake system, operating the second brake circuit for safely parking the motor vehicle for a certain number of actuations of the brake system, wherein the second brake circuit is no longer operated during additional actuations of the brake system while the motor vehicle is driven.

5. Suspension system calculation



SUSPENSION SYSTEM CALCULATION

SINGLE SHOCK ABSORBER:

Coil diameter ⇒ 10 mm
(n) no of coils ⇒ 15
$\alpha = 15$
D = 90 mm ⇒ R = 45 mm
W = Load on single spring
↓
Shock Absorb
↓
W = 43.25

Total Load = 173 kg
$\therefore \frac{173}{4} = 43.25$ Kg
43.25 kg ⇒ 425 N
$\therefore W = 425$ N

$M_0 = 10$ N-m $= 10 \times 10^3$ N-mm
$C = 0.84 \times 10^5$ N/mm²
$E = 2 \times 10^5$ N/mm²

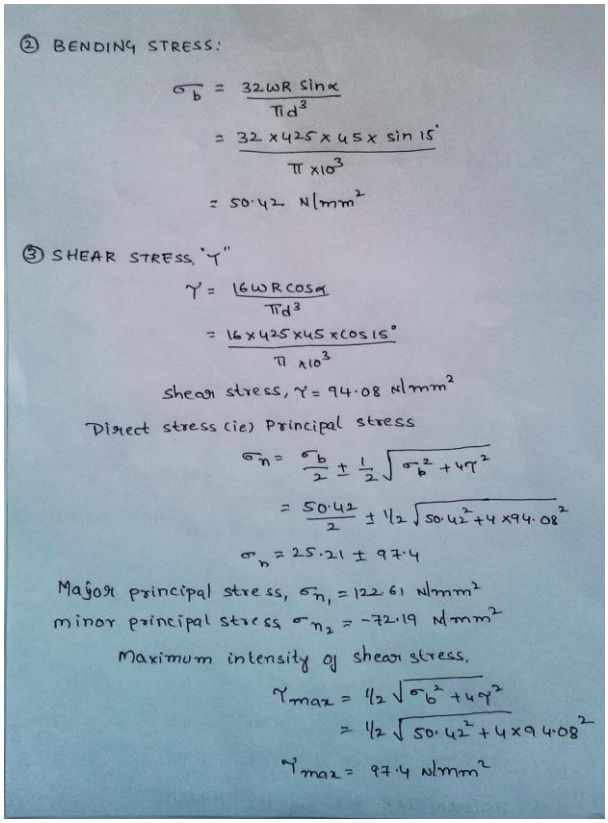
① DEFLECTION

$$\delta = \frac{64 W R^3 n \sec\alpha}{d^4}\left[\frac{\cos^2\alpha}{C} + \frac{2\sin^2\alpha}{E}\right]$$

$$= \frac{64 \times 425 \times 45^3 \times 15 \times \sec 15}{10^4}\left[\frac{\cos^2 15^\circ}{0.84\times10^5} + \frac{2\sin^2 15^\circ}{2\times10^5}\right]$$

$\therefore$ Deflection, $\delta = 45.33$ mm

NOTE :- The above deflection is for a single Spring (i.e) Single shock absorber.



② BENDING STRESS:

$$\sigma_b = \frac{32 W R \sin\alpha}{\pi d^3}$$

$$= \frac{32 \times 425 \times 45 \times \sin 15^\circ}{\pi \times 10^3}$$

$$= 50.42 \text{ N/mm}^2$$

③ SHEAR STRESS, "γ"

$$\gamma = \frac{16 W R \cos\alpha}{\pi d^3}$$

$$= \frac{16 \times 425 \times 45 \times \cos 15^\circ}{\pi \times 10^3}$$

Shear stress, $\gamma = 94.08$ N/mm²

Direct stress (i.e) Principal stress

$$\sigma_n = \frac{\sigma_b}{2} \pm \frac{1}{2}\sqrt{\sigma_b^2 + 4\gamma^2}$$

$$= \frac{50.42}{2} \pm 1/2\sqrt{50.42^2 + 4 \times 94.08^2}$$

$$\sigma_n = 25.21 \pm 97.4$$

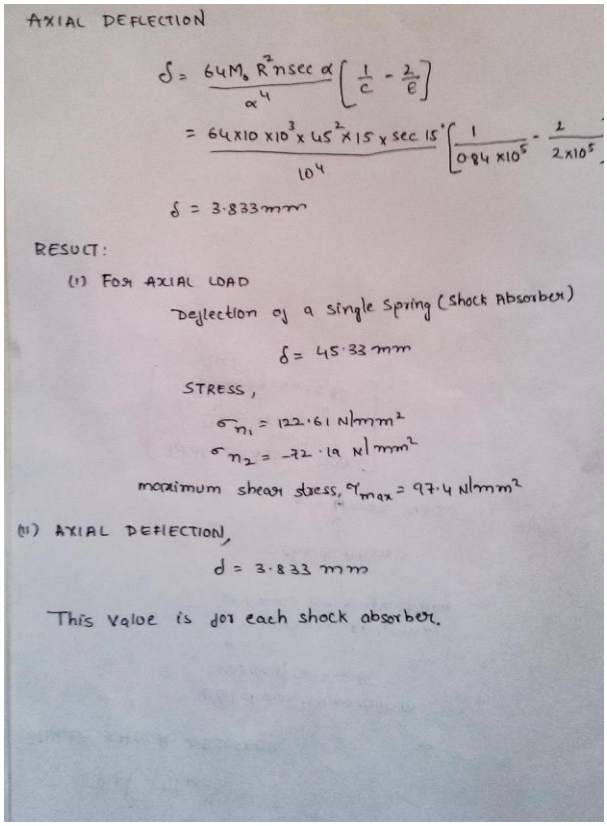
Major principal stress, $\sigma_{n_1} = 122.61$ N/mm²
minor principal stress $\sigma_{n_2} = -72.19$ N/mm²

Maximum intensity of shear stress,

$$\gamma_{max} = 1/2\sqrt{\sigma_b^2 + 4\gamma^2}$$

$$= 1/2\sqrt{50.42^2 + 4 \times 94.08^2}$$

$$\gamma_{max} = 97.4 \text{ N/mm}^2$$



AXIAL DEFLECTION

$$\delta = \frac{64 M_0 R^2 n \sec\alpha}{\alpha^4}\left[\frac{1}{C} - \frac{2}{E}\right]$$

$$= \frac{64 \times 10 \times 10^3 \times 45^2 \times 15 \times \sec 15^\circ}{10^4}\left[\frac{1}{0.84\times10^5} - \frac{2}{2\times10^5}\right]$$

$\delta = 3.833$ mm

RESULT:

(i) For AXIAL LOAD

Deflection of a single Spring (Shock Absorber)

$\delta = 45.33$ mm

STRESS,

$\sigma_{n_1} = 122.61$ N/mm²
$\sigma_{n_2} = -72.19$ N/mm²

maximum shear stress, $\gamma_{max} = 97.4$ N/mm²

(ii) AXIAL DEFLECTION,

$\delta = 3.833$ mm

This value is for each shock absorber.

Final calculation

Angular Velocity	=44.4 rad.s-1	
Frequency	=424.1	RPM
Peak Torque	=44.68 N-m	
Power Required (Peak)	=1985	Watt
Air Resistance	=325.85	Watt
Rolling Resistance	=489.44	
Power Required (Continuous)	=815.29 Watt	
Continuous Speed	=309.5 rpm	
Torque Required (Continuous)	=25.15 N-m	

6. Comparing with other car and savings

Table -1: comparing with other car

Basis of calculation	petrol car	Other electrical car	Solar Car
Fuel	Petrol	Electricity	Solar electricity
Fuel unit rate	RS /litter = 67/-	RS / charge unit =	charge unit
Mileage	km/litter =18kmpl	km/charge = 20 / hour of charge	km/charge = 24 / hour of charge
Fuel charges of 3600 km / Year	RS 13,400	RS 7,200	RS 0
Maintenance charges / year	RS 15,000	RS 12,000	Rs 12,000
Average cost / km	RS 7.9	RS 5.28	RS 3.0
Total cost / year	RS 28,440	RS 19,008	RS 10,800

7. Possible Innovations:

A .Auto tyre pressure monitoring system can be used to monitor the tyre air pressure and this system can fill in the air automatically when there is any decrement of the air pressure inside any of the tyres

b. Electro Mechanical Braking System using sensors can be introduced as an effective and advanced braking system.

C .The use of number of solar panels can also be increased based on the Mechanical Actuation system

d. By introducing an engine we can create a hybrid vehicle which will enhance the power of the vehicle in further

e. Sensors can be used in the solar panels that will act as an automatic tracking system which eases the process of tracking solar power direction by the solar panels

Photo 1 : manufacture

Photo 2 : manufacture

8. Advantages

• Unlike regular cars, solar energy powered cars are able to utilize their full power at any speed. • Solar powered cars do not require any expense for running. • Solar cars are quite. • Solar cars require very low maintenance. • A solar car produces no harmful emissions.

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BIOGRAPHIES

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