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Design and Development of ECO Friendly Solar Vehicle

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Abstract:
The rise in the price of oil and pollution issues has increased the interest on the development of electric vehicles. This project implements the application of solar energy to power up the vehicle. The basic principle of solar based electric vehicle is to use energy that is stored in a battery to drive the motor and it moves the vehicle in forward or reverse direction. The Photo Voltaic (PV) module may be connected either in parallel or series, and the charge controllers direct this solar power to the batteries. The DC voltage from the PV panel is stored in the battery. This is used to drive the DC motors, which are attached to the wheels and axles to drive the vehicle. The solar car is environment friendly; also it does not involve any fuel cost as it runs on solar energy which is available free of cost to everyone. Also the car is quiet in operation due to absence of engine.

Keywords:
Solar car, photovoltaic cells, DC motor, non-conventional energy driven vehicles etc.

I. INTRODUCTION:

Now-a-days, dealers of natural resources like fuel, coal etc. are facing a hard time to keep pace with the increasing demand.

At one hand, there are more cars or motor vehicles are dominating the transport medium, on the other hand these cars are being dominated by the fuel. As a result, the limited resources are being quashed by the producers and dealers to satisfy this need which is leading us to an uncertain future with having the scarcity of fuel and minerals. So, it is clear that present Trends in energy consumption, especially oil, cannot be sustained much longer. Again, in view of the possibility of global warming, these resources are playing a negative role. Therefore, under this circumstances, it is quite necessary to make a new exploration of natural resource of energy and power. But why exploration when the resource is in front of our bear eye. It is effective, less expensive and above all, it is an endless source of energy. With greatly Improved energy efficiency, a transition to this energy based economy capable of sustaining the anticipated growth in the world economy, is possible. This effective source is “Solar Energy”.

PROBLEM STATEMENT:

Fuel costs are increasing day by day, also the fossil fuels are non-renewable energy source. The resources of fossil fuels are depleting day by day, are on the way of extinction.

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So in order to meet ever increasing need of energy of increasing population we must search for new alternative energy sources. Out of which solar energy is considered the best source, as solar energy is available in bulk and at free of cost. So in order to utilize the solar energy we are designing and developing a solar car which will run using solar energy.

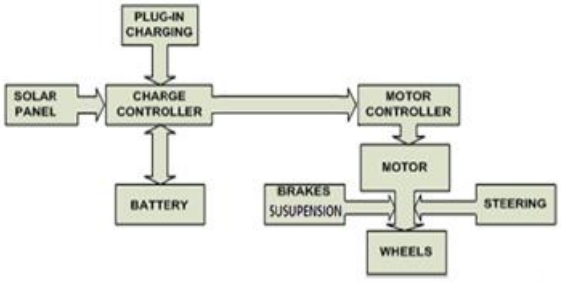
II.LITERATUREREVIEW:

Immanuel Alphonse et.al.Says in the paper "Design of Solar Powered BLDC Motor Driven Electric Vehicle" that any equipment without power is an idle bunch of components. It is very prominent with those dependable Upon the non-renewable sources. It's a pro-active approach to shift our source of energy to renewable source. This paper details the study of designing a Solar Powered BLDC Motor Driven Electric Vehicle which is one of the solutions for the oncoming crisis. The approach of selecting the appropriate components for this application is studied and each of them are simulated and subjected to various tests in real time environment. The integrated system consisting of the solar module, charge controllers, batteries, boost converter and BLDC motor, henceforth developed into the Solar Powered Electric Vehicle. A. BharathiSankar et.al. Says in the paper "Simulation and Implementation of Solar Powered Electric Vehicle" that the rise in the price of oil and pollution issues has increased the interest on the development of electric vehicles. This paper discusses about the application of solar energy to power up the vehicle. This paper focuses on the design, simulation and implementation of the various components, namely: solar panel, charge controller, battery, DC-DC boost converter, DC-AC power converter (inverter circuit) And BLDC motor for the vehicle application. All these components are modeled in MATLAB/SIMULINK and in real-time, the hardware integration of the system is developed and tested to verify the simulation results.

SayidulMorsalin et.al.Says in the paper "Design and Fabrication of a Solar Powered Toy Car" that for running a model car or toy car which is a miniature representation of an automobile, electric power is needed to run the car. As there lies shortage of electric power in Southeast Asian country, it has become a vital issue to initiate the use of renewable energy in developing countries like Bangladesh for reducing the demand of electricity. This paper deals with an attempt to investigate the energy recovery possibilities from the solar energy by using a solar panel which converts light energy from the sun into electrical power. That power is transmitted to the storage battery. The stored power of battery is used to run the car. T.Balamurugan et.al. Says in the paper "Design of Solar/Electric Powered Hybrid Vehicle (SEPHV) System with Charge Pattern Optimization for Energy Cost" that a Solar Electric Powered Hybrid Vehicle (SEPHV) system which solves the major problems of Fuel and pollution. An electric vehicle usually uses a battery which has been charged by external electrical power supply. All recent electric vehicles present a drive on AC power supplied motor. An inverter set is required to be connected with the battery through which AC power is converted to DC power. During this conversion many losses take place and also the maintenance cost of the AC System is very high. The proposed topology has the most feasible solar/electric power generation system mounted on the vehicle to charge the battery during all durations. With a view of providing ignited us to develop this "Solar/Electric Powered Hybrid Vehicle" [SEPHV].

III.SYSTEM ARCHITECTURE:

BLOCK DIAGRAM:



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DESIGN CONSIDERATIONS:

To design and fabricate high performance racing vehicle which will be safe by ergonomically, economically and by all means safety considerations following main parameters were set before the Designing; on which whole design process is carried out,

I. Driver Ergonomics.
II. Serviceability and maintainability.
III. Maneuverability.
IV. Design of flexible roll cage.
V. Use of optimum power efficiency.
VI. Cost of the components.

To meet all above considerations and for ease in designing; all systems were designed individually along with mutual specifications considerations for interchangeability.

I. Roll Cage
II. Steering System
III. Braking System
IV. Power train System

In a solar car, there are mainly seven parts. They are,

1. Chassis
2. DC Motor
3. Steering
4. Tires
5. Brake
6. Solar panel
7. Battery

1. **CHASSIS:** The skeleton is to a great degree imported component of the kart, as it must give, by means of flex, the likeness suspension to give great hold at the front. Karts have no suspension, and are typically no greater than is expected to mount a seat for the driver and a little motor. Suspension development is regularly of a square pole development, normally MS with various evaluations. In this car, we utilize MS pole. The suspension bolster the power unit, control prepare, the running framework and so forth.

2. **Steering system:** The steering of a go-kart is not that much sensitive because we used mechanical steering mechanism but not rack and pinion mechanism. Rack and pinion mechanism is much costlier compared to mechanical steering mechanism.

3. **Tires:** For go-karts, haggles are much littler than those utilized on a typical auto. The tires will have expanded hold and a hard one. And furthermore it can withstand The high temperature.In this kart, we utilizetires having 15" diameter for front and for back. This is utilized for a streamlined shape. The tires must have weight of no less than 18 psi.

4. **Brake: Standard:** A drum brake is a brake that utilizations grating brought on by an arrangement of shoes or cushions that press against a turning drum-formed part called a brake drum. It's a given that brakes are a standout amongst the most essential control segments of vehicle. They are required to stop the vehicle inside the littlest conceivable separation and this is finished by changing over the active vitality of the vehicle into the warmth vitality which is dispersed into the environment. The term drum brake normally implies a brake in which shoes push on the inward surface of the drum.

5. **DC MOTOR:** The electric motor is a device which converts electrical energy to mechanical energy. There are mainly three types of electric motor. All of these motors work in more or less same principle. Working of electric motor mainly depends upon the interaction of magnetic field with current.

   Specifications:
   The DC motor used will be a 24 Volt, 450 Watt motor.

6. **SOLAR PANEL:** Solar energy is a resource that is not only sustainable for energy consumption, it

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is indefinitely renewable. Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating.

Specifications:
A 12 Volt and 20 Watt solar panel will be used.

7. **LEAD ACID BATTERY:** The lead-acid battery was invented in 1859 by French physicist Gaston Planté and is the oldest type of rechargeable battery. Despite having a very low energy-to-weight ratio and a low energy-to-volume ratio, its ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio. These features, along with their low cost, makes it attractive for use in motor vehicles to provide the high current required by automobile starter motors.

Specifications:
A 12 Volt, 7Amp battery will be used.

IV.SYSTEM DESIGN:

Design of frame:

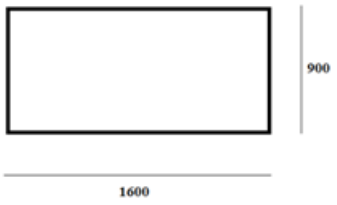

Fig. 1 frame

M/I=σb/y……(1)
Bending moment(M)=force *perpendicular distance
=60*450*9.81
Bending moment (M)=264870 Nmm

I=((b(h^3)))/12=((25(25^3)))/12
=32552.08 mm4
Y=25/2=12.5

Therefore above value use in equation no(1).
264870/32552.08 = σb/12.5
Therefore, σb=101.71 Nmm2 or MPa
σallow= Syt of mild steel/ factor of safety = 210/2 = 105 MPa
Since 101.71 <105MPa Hence design is safe.

Design of shaft:

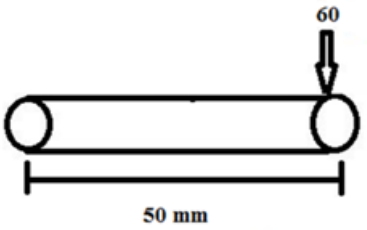

Fig. shaft

M/I=σb/Y ……(1)
Bending moment=force*perpendicular distance
Bending moment=60*9.81*50
=29430 Nmm
For diameter 15mm,

I=π/64*d4=π/64*154=2483.78
Therefore,
29430/(2483.78)=σb/(7.5)
σb = 88.86 N/mm2 or MPa
σallow = Syt of mild steel/ factor of safety = 210/2 = 105 MPa
Since 88.86<105MPa Hence design is safe.

V.ADVANTAGES AND APPLICATIONS:

ADAVANTAGES:

- 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.
- It is quite in operation.
- Solar cars require very low maintenance.
- Solar cars produces no harmful emissions.

APPLICATIONS:

Solar car has wide applications in industry. It can be used in passenger cars, also solar train is implemented

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in our country itself. This technology can be used to run heavy duty vehicles also.

VI.FUTURE SCPOE:

It can be modified to utilize as material handling device in industry. Also now it is developed as a go cart model it cart model it can be developed as professional car for mass production purpose. Also it can be used for heavy duty vehicle by imposing more number of solar panels on it to increase its capacity.

VII.CONCLUSION:

The solar vehicle solves many problems related to environment and is the best pollution free method. We need to make use of them so that we can reduce our dependence on fossil fuels. Solar vehicles have some disadvantages like small speed range, initial cost is high, but these disadvantages can overcome by conducting further research in this area, like the Problems of solar cells can be solved by using the ultra-efficient solar cells that give about 30-35%efficiency.

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