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Design of Solar Electric/ Hybrid Vehicle

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ABSTRACT: The project is about to power up the electric cars and achieve the maximum distance of running. The electric car most commonly seen in the roads but the main problem of electric vehicle are there is no continues recharging sources, so we implementing a new project on electric vehicle by using solar power and dynamo. The solar power can be produced from the sun light by using the solar panel and the dynamo will convert the mechanical energy to electrical energy from wheels of the vehicle. It can be used to avoid the plug in charge. We design the solar power hybrid electric vehicle model by two software. The chassis and frame work analysis are done by using the ANSYS work bench and the energy calculations which are done by using 2016A mat lab. This type of technique is to reduce the running cost and increasing the running efficiency of the vehicle. The performance of the vehicle was found to be satisfactory for the load of four people with the average speed of 60km/hr. By using this we can be able to reduce the all kind pollutions and the fuel economy. The main systems that we are using are PMDC motor, solar module, Charge Controller, Batteries, Boost Converter, Step-down Transformer; Diode Rectifier Experimental results are presented to confirm the theoretical analysis.

KEYWORDS: PMDC motor, solar module, Charge Controller, Batteries, Boost Converter, Step-down Transformer; Diode Rectifier.

I. INTRODUCTION

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. 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 and also for public use List of prototype solar-powered cars. 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 ultra-light composite bodies to save weight. Solar cars lack the safety and convenience features of conventional vehicles. The first solar family car was built in 2013 by students in the Netherlands. This vehicle is capable of 550 miles on one charge during sunlight. It weighs 850 pounds and has a 1.5kw solar array. Solar vehicles must be light and efficient. 3,000 pound or even 2,000 pound vehicles are less practical. Stella Lux is a family hybrid car with solar energy having higher efficiency. The predecessor to Stella broke a record with a 932 mile single charge range. The Dutch are trying to commercialize this technology. During racing Stella Lux is capable of 700 miles during daylight. At 45 mph Stella Lux has infinite range. The average family who never drive more than 200 miles a day would never need to charge from the mains. They would only plug in if they wanted to return energy to the grid.. 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. The difficulty occurred in the continues recharging is avoided by the system used. The dynamo used for the continues recharging in the hybrid vehicle and also the solar panel absorbs the sunlight and produces electrical energy using photo voltaic cells. It transmits to the battery and the vehicle runs by using the battery charge.

II. PROBLEM STATEMENT

The electric vehicles are mainly used for reduce the use of fuel and avoid pollution. There is no continues charging medium provided for the electric vehicles. The limited distance can be only travelled by one time charging. The dynamo can be introduced into the system for continues charging.

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Due To Above Conditions Following Problem Occurs:

- After the limited distance the car doesn't run.
- If it is dark out for many days the car battery will not charge.
- There is limitation for running speed.
- Investment cost is higher.
- Works based on whether condition.
- Cannot run in the hill areas and high range.
- Limitation for the carrying luggage's.

III. PROBLEM SOLUTIONS

- The solar panel can be fixed for producing electric power from sun light.
- The dynamo can be introduced into the system for continues charging.

4. EXISTING METHOD

Solar cars use energy that produced by the sun. Direct exposure to sunlight doesn't move cars or other devices that can use this energy, so the converter of sun rays into usable power is needed. When it comes to solar cars, specially designed batteries serve as converters. Solar energy also needs to be stored since sun is not always available. Silicon-based photovoltaic cells are still most common solar collector and storage space where, due to electron movements and interactions, accumulated sunlight moves electrons around. These movements and interactions of electrons trigger electrical current or energy that eventually runs the car through DC motors.

Flow chart for Solar electric hybrid vehicle

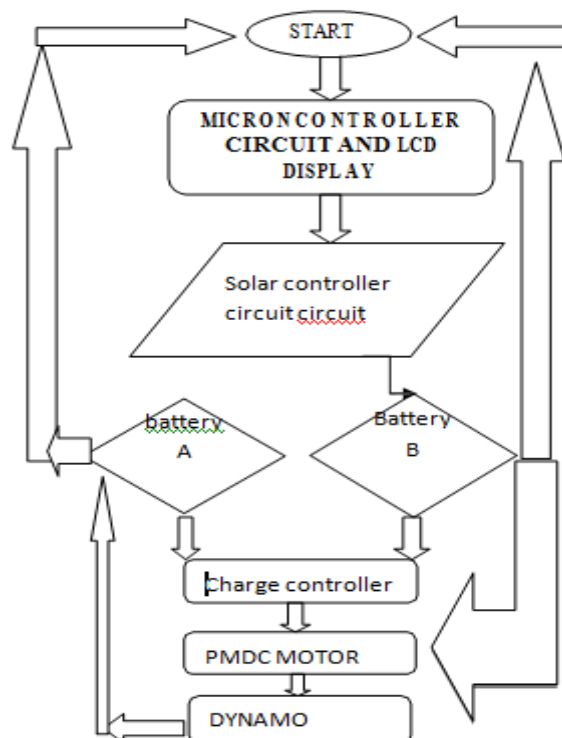


Figure no 1: flow chart of solar electric / hybrid vehicle

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III. DESIGN OF CHASSIS

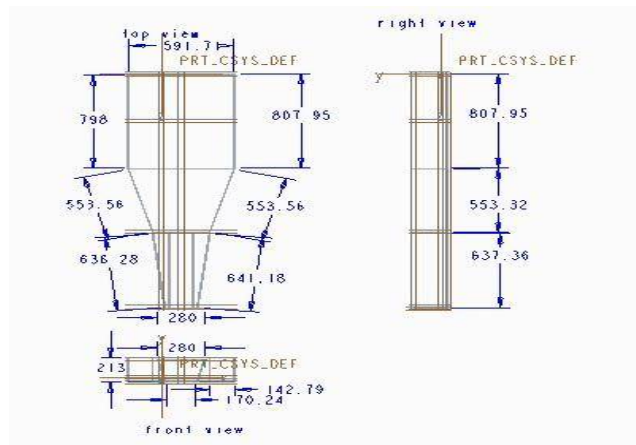


Figure no 2.Chassis design view

3.1 CHASSIS ANALYSIS:

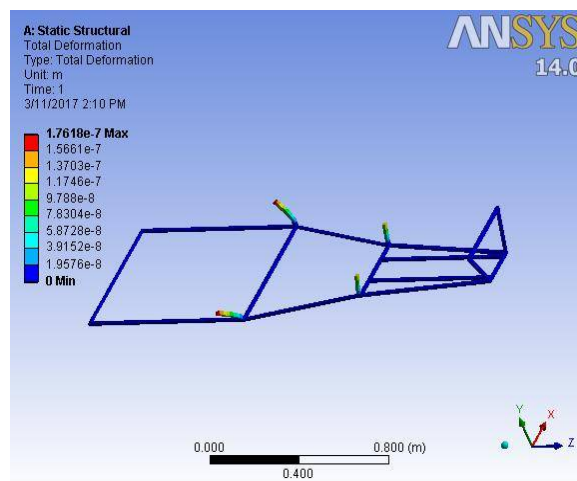


Figure no3.Total deformation analysis

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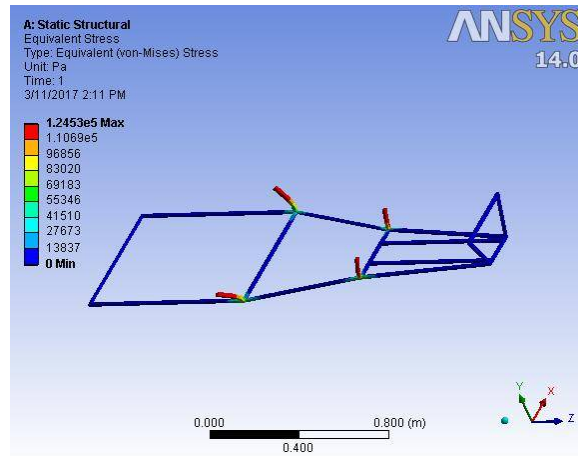


Figure no 4. Equivalent stress analysis

Structural Steel > Strain-Life Parameters

Strength Coefficient Pa	Strength Exponent	Ductility Coefficient	Ductility Exponent	Cyclic Strength Coefficient Pa	Cyclic Strain Hardening Exponent
9.2e+008	-0.106	0.213	-0.47	1.e+009	0.2

Table:1 Analysis properties

There is the distribution of 95kg weight at the front portion of the chassis. The engine is not provided for electrical vehicles, the fixtures such as PMDC motor (25 kg) and lead-acid battery (48 kg). The charge controller and circuits for running the vehicle have the weight at about (22 kg). The weight of the frame and the solar panel is about 400 kg. The total weight of vehicle is optimized as 500 kg. The stress occurring and the deformation takes place is analyzed by the ANSYS 14.0 Software. The reduction of weight in the system for the higher efficiency of vehicle. The vehicle which having the 50 km/hr.

3.2 COMPONENTS USED

- Solar Panel
- Solar controller circuit
- Batteries
- PMDC Motor
- Pic Microcontroller 16F877
- Starter switch
- Dynamos
- LCD display

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3.2.1 SOLAR PANEL

A solar cell or photovoltaic cell is a wide area electronic device that converts solar energy into electricity by the photovoltaic effect. Photovoltaic is the field of technology and research related to the application of solar cells as solar energy. Sometimes the term solar cell is reserved for devices intended specifically to capture energy from sunlight, while the term photovoltaic cell is used when the source is unspecified. Assemblies of cells are used to make solar modules, or photovoltaic arrays.

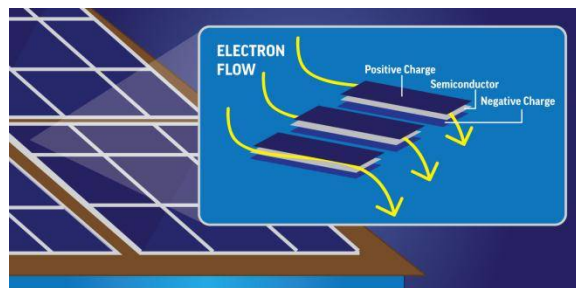


Figure no 5. Solar panel

3.2.2 SOLAR CONTROLLER CIRCUIT:

A Solar charge controller, charge regulator or battery regulator limits the rate at which electric current is added to or drawn from electric batteries. It prevents overcharging and may protect against overvoltage, which can reduce battery performance or life span and may pose a safety risk. It may also prevent completely draining (“deep discharging”) a battery or perform controlled discharges, depending on the battery technology, to protect battery life. The terms charge controller or charge regulator may refer to either a stand-alone device, or to control circuitry integrated within battery pack, battery powered device.

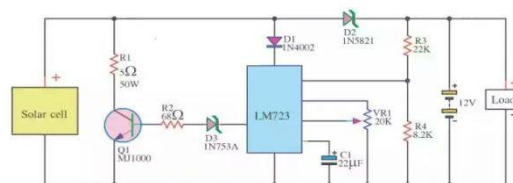


Figure no 6.solar controller circuit

3.2.3 BATTERY:

The lead acid battery are despite having a very low energy-to-weight ratio, and a low energy- to-weight volume ratio, it’s ability to supply high surge currents means that the cell have relatively large power- to- weight ratio these features, along their low cost, makes it attractive for use in motor vehicles to provide the high current require by automobile starter motor.

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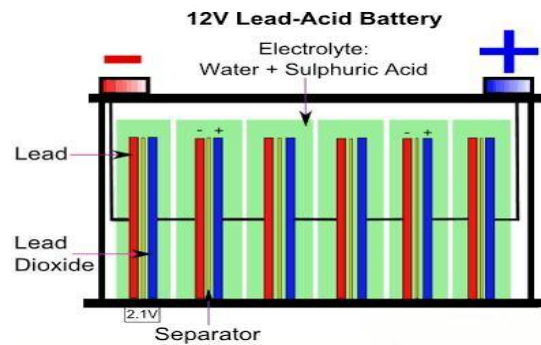


Figure no 7.lead acid battery

3.2.4 PMDC MOTOR:

The stator is the fixed part of the motor, in which the rotor rotates. The stator consists of a pair of permanent magnets aligned so that poles of opposite polarities forces each other. Thus one magnet has its North (N) pole close to the armature, while the other magnet has its South(S) pole close to the armature. Therefore, lines of magnetic field pass from one permanent magnet to other through the metallic armature.

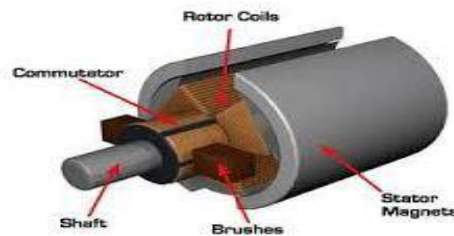


Figure no 8 . PMDC Motor

3.2.5 PIC MICROCONTROLLER:

PIC (usually pronounced as "pick") is a family of microcontrollers made by Microchip Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to Peripheral Interface Controller. The first parts of the family were available in 1976; by 2013 the company had shipped more than twelve billion individual parts, used in a wide variety of embedded systems.

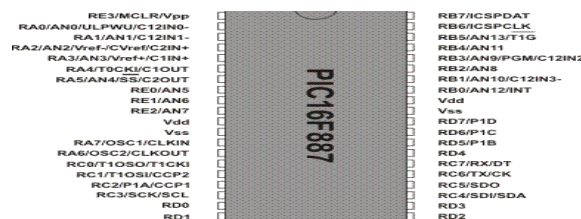


Figure no.9 pin diagram for pic16f887

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3.2.6 STARTER SWITCH :

A starter solenoid (or starter relay) is the part of an automobile which switches a large electric current to the starter motor, in response to a small control current, and which in turn sets the engine in motion. Its function is thus identical to that of a transistor, but using an electromagnetic solenoid rather than semiconductor to perform the switching.

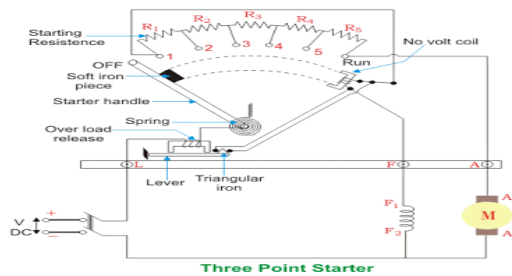


Figure no.10 starter switch

3.2.7 DYNAMO:

As from the introduction about the dynamo it is a device which converts mechanical energy in to electrical energy this is the basic principle used here and its is used for low power applications .Each dynamo is capable of producing 24v that can be used for low power application . Hence on seeing this situation the dynamos are used to fill up or produce a charge at this time hence you will not loss your efficiency of the car.



Figure no.11 wheel dynamo hub system

3.3 MAT LAB ANALYSIS

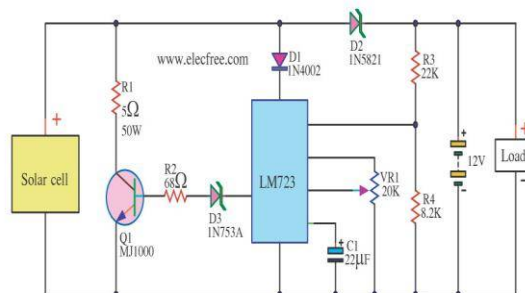


Figure no12 . solar panel to the load applying

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In electronics is a linear regulator is a system used to maintain a steady voltage the resistance of the regulator varies in accordance with the load resulting in a constant output voltage. The regulating device is made to act like a variable resistor, continuously adjusting a voltage divider network to maintain a constant output voltage and continually dissipating the difference between the input and regulator voltages as waste heat. By contrast a switching regulator uses an active device that switches on and off to maintain an average value of output . because the regulated voltage of a linear regulator must always be lower than the input voltage, efficiency is limited and the input voltage must be high enough to always allow the active device to drop some voltage .

The vehicle performance can be obtained by using the analysing in the mat lab. The first graph shows the accelerator performance of the vehicle for 16 seconds. The second graph shows the car speed(km/hr). The third represents drive torque and fourth gives the electrical power outputs.

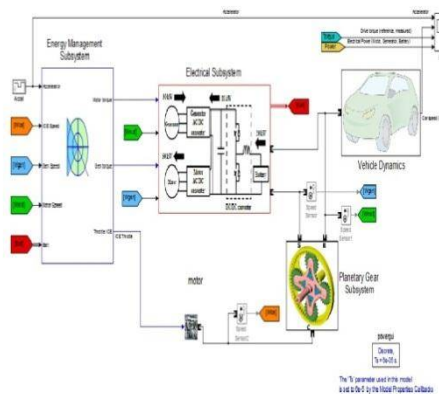


Figure no13. Vehicle performance analysis

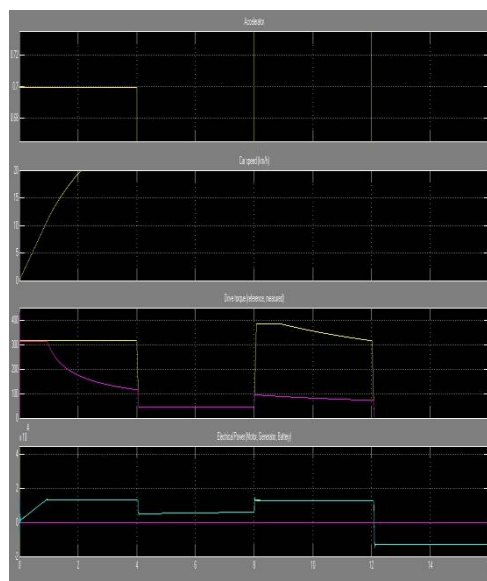


Figure no 14 . Analysed result for various accelerations

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3.4 APPLICATIONS :

- Ride Through Pollution Free Areas.
- Better For City Riding.
- It Can Be Applicable In Desert Areas.
- Applicable The Lag Of Fuel Availability Areas
Such As Islands .
- Solar Electric Taxis For Avoid Pollution.

IV. CONCLUSION

The solar electric hybrid vehicle solves problems related to environment and pollution. The continues running of vehicle can be obtained by the application of dynamo in the vehicle. The efficiency of solar electric hybrid vehicle obtained 100 percentage efficiency as compared to existing electric vehicle . The house hold electric supply of 230v reduced with step-down transformer to 48v. And it is converted to D.C with a charge controller unit. The solar electric hybrid vehicle we designed is to rectify the problem occurring that the limited distance running of electric vehicles. The efficiency and running of solar electric hybrid vehicle was verified by theoretical results.

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