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Note on RECENT TECHNOLOGIES

Use of Photo Voltaic Panels to increase the Car's mileage

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Abstract: The main aim of this paper is to increase the mileage of cars by reducing the electrical load's supply from the dynamo and supplying electrical power using photovoltaic panels. The main electrical loads such as AC compressor, Headlights, music system, horns etc. can be fed by the PV panels. Approximately we can increase the mileage by 2 to 3 kilometers per litre.

Keywords: *Air-conditioner, Compressor, Mileage, PPT, Photovoltaic panel, PMDC Motor***.**

1. INTRODUCTION

The Main electrical components of cars are Air-Conditioning System, Sound Systems, Headlights, Decorative Lighting and Horns. Our aim of the project is to supply all the electrical needs of the car by using solar panel thereby reducing the fuel consumption and increasing the mileage of the vehicle. Sound System, Headlights, Decorative Lighting and Horns are directly connected to thebattery provided in the car. The main Load is AC System.

1.1. Electrical Components of a Car

Headlights, Self-motor, Ignition System, Air compressor (Partially Electrical which can be fully converted into Electrical).

1.2. Electrical Load in a Car

Main Load: Using High Rated DC Permanent Magnet Motor to Drive the AC System. (Belt drive mechanism is used).

Other Loads: Connecting all the Electrical loads to the solar panel's supply.

Backup: Using Additional battery Backup for all other electrical components.

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2. DESIGN PROCEDURE

The components used in the study are

A. Solar panels

Solar modules use light energy (photons) from the sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells based on cadmium telluride or silicon. The structural (load carrying) member of a module can either be the top layer or the back layer. Cells must also be protected from mechanical damage and moisture. Most solar modules are rigid, but semi-flexible ones are available, based on thin-film cells.

Electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired current capability. The conducting wires that carry the current off the modules may contain silver, copper or other non-magnetic conductive [transition metals]. The cells must be connected electrically to one another and to the rest of the system. Externally, popular terrestrial usage photovoltaic modules use MC3 (older) or MC4 connectors to facilitate easy weatherproof connections to the rest of the system. Bypass diodes may be incorporated or used externally, in case of partial module shading, to maximize the output of module sections still illuminated. Some recent solar module designs include concentrators in which light is focused by lenses or mirrors onto an array of smaller cells. This enables the use of cells with a high cost per unit area (such as gallium arsenide) in a cost-effective way. The efficiency of a module determines the area of a module given the same rated output – an 8% efficient 230 watt module will have twice the area of a 16% efficient 230 watt module. There are a few commercially available solar panels that exceed 22% efficiency and reportedly also exceeding 24%. The price of solar power, along with batteriesfor storage, has continued to decline so that in many countries it is cheaper than ordinary fossil fuel electricity from the grid.

B. Source Selector

A Small circuit that detect the source to be connected is incorporated inside the charge controller to select either solar or alternator from Engine.

C. Charge Controller

MPPT – For Higher End Cars – Higher Power Rating

PWM – For Lower End Cars – Lower Power Rating

A charge controller, or charge regulator is basically a voltage and/or current regulator to abstain batteries from overcharging. It regulates the voltage and current coming from the solar panels going to the battery. Most "12 volt" panels put out about 16 to 20 volts, so if there is no regulation the batteries will be damaged from overcharging. Most batteries need around 14 to 14.5 volts to get fully charged. Generally, there is no need for a charge controller with a small maintenance, or trickle charge panels, such as the 1 to 5 watt panels.

Standard MPPT types (Fig. 1 & 2), will often work with high voltage panels if the maximum input voltage of the charge controller is not exceeded. However, we will lose a lot of power - from 20 to 60% of what our panel is rated at. Charge controls take the output of the panels and feed current to the battery until the battery is fully charged, usually around 13.6 to 14.4 volts. A panel can only put out so many amps, so while the voltage is reduced from say, 33 volts to 13.6 volts, the amps from the panel cannot exceed the rated amps - so with a 175 watt panel rated at 23 volts/7.6 amps, you will only get 7.6 amps at 12 volts or so into the battery. Ohms Law tells us that watts is volts x amps, so our 175 watt panel will only put about 90 watts into the battery.

A MPPT, or maximum power point tracker is an electronic DC to DC converter that optimizes the match between the solar array (PV panels), and the battery bank or utility grid. To put it simple, they convert a higher voltage DC output from solar panels (and a few wind generators) down to the lower voltage required to charge batteries.

Maximum Power Point Tracking is electronic tracking - usually digital. The charge controller looks at the output of the panels, and compares it to the battery voltage. It then figures out what is the best power that the panel can put out to charge the battery. This is converted into the best voltage to get maximum AMPS into the battery.

Most modern MPPT's are around 93-97% efficient in the conversion. You typically get a 20 to 45% power gain in winter and 10-15% in summer. Actual gain can vary widely depending weather, temperature, battery state of charge, and other factors.

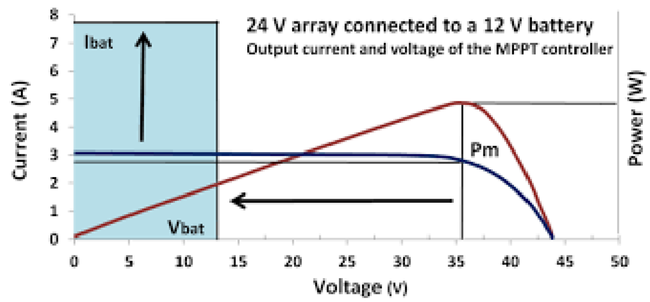

Fig 1. Output Current and Voltage of the MPPT Controller.

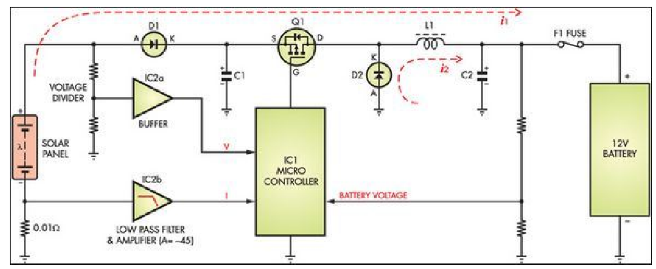

Fig 2. MPPT Charge Controller Circuit.

D. Lead Acid Battery

An automotive battery is a rechargeable battery that supplies electric energy to an automobile. Traditionally, this is called an SLI i.e Starting, Lighting, Ignition, and its main purpose is to start the engine. Once the engine is running, power for the car is supplied by the alternator. The starting discharges less than three per cent of the battery capacity. SLI batteries are designed to release a high burst of current, measured in amperes, and then be quickly recharged. They are not designed for deep discharge, and a full discharge can reduce the battery's lifespan.

As well as for starting the engine an SLI battery supplies the extra power necessary when the vehicle's electrical requirements exceeds the supply from the charging system. It is also a stabilizer, evening out potentially-damaging voltage spikes.

The alternator inclusive of a voltage regulator maintains the output between 13.5 and 14.5 V. Modern SLI batteries are lead-acid type and provide 12.6 volts of direct current, nominally 12 V. The battery is actually six small batteries, or cells, connected in series. Battery electric vehicles are powered by a high-voltage electric vehicle battery, both they usually have an automotive battery as well, so that it can be equipped with standard automotive accessories which are designed to run on 12 V.

E. PMDC Motor

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line. When permanent magnet is used to create magnetic field in a DC motor, the motor is referred as permanent magnet DC motor or PMDC motor.

These types of motor are essentially simple in construction. These motors are commonly used as starter motor in automobiles, windshield wipers, washer, for blowers used in heaters and air conditioners, to raise and lower windows, it is also extensively used in toys. As the magnetic field strength of a permanent magnet is fixed it cannot be controlled externally, field control of this type of dc motor cannot be possible.

Thus permanent magnet DC motor is used where there is no need of speed control of motor by means of controlling its field. Small fractional and sub fractional kW motors are now constructed with permanent magnet.

3. BASIC BLOCK DIAGRAM

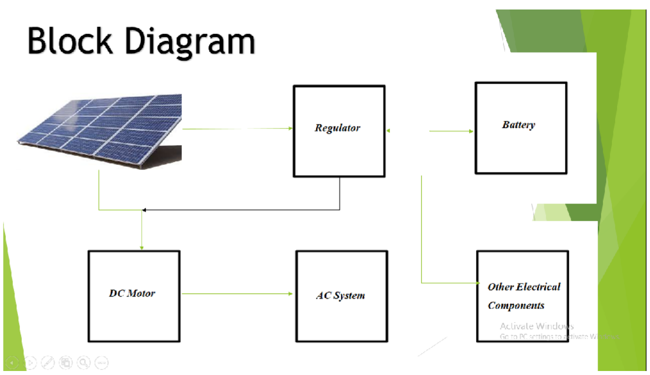

Fig 3. Block Diagram

4. APPROXIMATE SAVING (ON 2016)

Diesel Engine

Average life of a car is 15 years. Average mileage ranges from 12 to 20 KMPL. With the addition of above discussed module the mileage increases on a scale of 15 to 25 KMPL and the amount of reduced fuel is 1500L to 5000L.
Amount put aside ranges from Rs.70500 to Rs.2, 35,000.

Petrol Engine

Average life is 15 years. Average mileage ranges from 10 to 18 KMPL. With the addition of above said module the mileage rises to 14 to 22 KMPL and the amount of fuel usage reduced is 1515L to 4285L .Amount saved ranges from Rs.90000 to Rs.2, 57, 000.

4. CONCLUSION

Approximately we can increase the mileage by 2 to 3 kilometers per litre. We can retain around 20% of the total cost which we spend on fuel. The Large scale production of this module and integrating in the manufacturing phase of a car itself will increase the fuel efficiency and reduce the pollution.