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Solar Powered Plug-in Electric car

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Abstract- The Solar powered plug-in electric vehicle is an economic vehicle with minimum maintenance. The main drawback of electric vehicles is the limitation of driving distance. By adding a solar PV module the vehicle battery can be charged while on drive. Here the mechanical parts like gearbox and differential are avoided. Direct drive to wheels allow efficient drive.

Keywords- BLDC, Solar PV, Solar Electric Car (SEC)

I. INTRODUCTION

The whole world is moving with automobiles. Huge amount of fossil fuels are burned for automobiles. Nothing on earth is free of cost, but what if we could find a way to implement free rides? Indeed it would be wonderful if our cars could continue to run without us having to spend billions of fossil fuels every year and to deal with natural hazards that their combustion leave behind. Considering the availability and pollution of fossil fuels we need a substitute. The best substitute is electric vehicles which will not create any pollution to environment. The main impediment is the storage capacity of electric power, the ride is restricted up to battery capacity. This storage issue can be beaten by adding solar power to automobiles. By adding PV

modules the vehicles can be charged while driving by this the driving distance can be increased. If we could

drive a solar-powered car, that auto dream would come true. Solar cars would harness energy from the sun via solar panels. A solar panel is a packaged, connected assembly of solar cells, also called photovoltaic cells which are solid state devices that can convert solar energy directly into electrical energy through quantum mechanical transitions.

They are noiseless and pollution-free with no rotating parts and no need minimum maintenance. The electricity thus generated would then fuel the battery that would run the car's motors.

Unlike a single motor operation our vehicle is driven with two motors which are placed at the wheel hubs. By this mechanical parts like gearbox clutch drive axles can be eliminated, so the regular mechanical maintenances are not required.

II. LITERATURE SURVEY

With the increasingly severe environmental problems around the world, exploitation of clean and renewable energy has been a crucial topic. As indispensable transportation in modern society,

vehicles are ubiquitous but also one of the main sources of pollutants. Because of their status, it is almost impossible to decrease the volume of vehicles. One solution to lowering emissions is the electric vehicle. Overall, the electric vehicle is more energy efficient, environmentally friendly, and cleaner than the vehicle that relies on fossil fuels.

An electrically powered vehicle has essentially three major electrical components. These include energy source (usually are chargeable battery bank), an inverter or, motor controller and an electric motor. In the case of a solar car, the energy source is typically a bank of batteries, which may be recharged by photovoltaic solar panels. The motor controller is typically a power electronics device which when supplied with the driver's input commands, controls the torque and speed of the electric motor

The solution is SPEV is supported with a charging cable that plugs in to the vehicle and into a 230v wall socket. The electric vehicle have a built in features like security system, Seatbelt Detection system, Collision detection.

Hence, by incorporation of the solar photovoltaic panels, the range of the Battery powered cars can be increased. Electric vehicles are currently emerging in the present market and the automobile industry is investing a lot of their R & D resources for the development of electric solar vehicles. These are the future of zero carbon emissive car transportation. The present work aims to develop a model of plug-in electric solar vehicle and discusses

the design parameters of these vehicles to come in the market.

III. PROPOSED SYSTEM

The proposed vehicle is not a complex one. It is very simple in construction compared to Fuelled vehicles. Electric vehicle's layout is shown in fig 1. System mainly consist of two motors with controllers, reversing circuit, battery pack, solar PV module with charge controller and an accelerator.

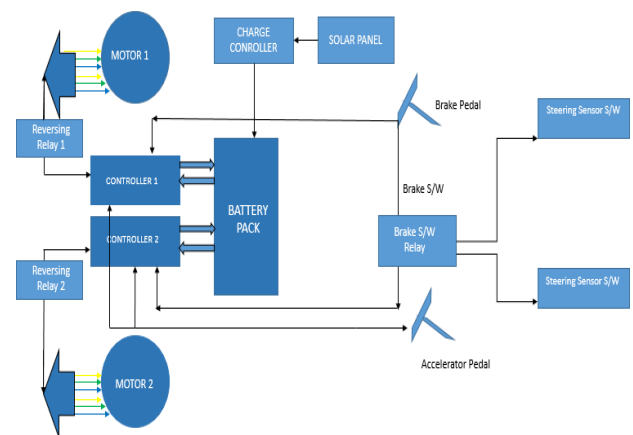


Fig1.Basic Block diagram

VI. HARDWARE COMPONENTS

SOLAR PANEL

Solar panels work by harnessing the power of sunlight and converting it into usable electrical energy. The panels are made up of photovoltaic cells, which are typically made from silicon, when sunlight hits these cells, it excites the electrons within them, creating an electric current.

**Fig 2: Solar Panel**

This current is then captured and can be used to power various devices, such as solar cars. The more sunlight the panels receive, the more energy they can generate. It's pretty amazing how sunlight can be transformed into clean and renewable energy.

BATTERY

The battery plays a crucial role. The solar panels on the car generate electricity from sunlight, which is then stored in the battery. The battery acts as a power reservoir, storing the energy for later use.

**FIG 3: DC Battery**

When you ride the car, the motor draws power from the battery, providing assistance and making your ride easier. The battery also allows you to ride even when there's no direct sunlight, as it stores energy for cloudy days or nighttime. It's like having a backup power source that keeps you going on your solar-powered adventures.

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MOTOR CONTROLLER

The motor controller is the heart of the vehicle. All the electric parts of the vehicle are controlled by this. A BLDC motor controller is shown in Fig 4. It controls the speed of motor, breaking, battery voltage calculation, speedometer control and electrical accessories control. It has two wires from battery pack, 3 phase wires, 5 rotor position sensor wires, wire to accelerator, brake sensor wires from brake pedal, speed

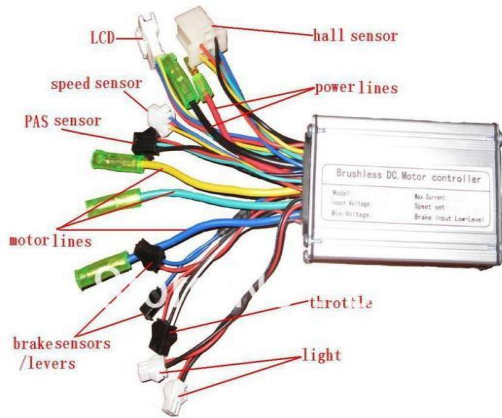


Fig4.BLDC motor controller

Regulator wire, speedometer wires, electrical accessory wire for lights, and wire to DC-DC converter. Motor controller consists of IGBT Switching transistors for controlling motor rotation.

BLDC MOTOR

A brushless DC motor (BLDC motor) is an electronically commuted DC motor which does not have brushes. BLDC motor is shown in Fig 5.



Fig 5. BLDC motor

The BLDC motor is driven by an electronic drive which switches the supply voltage between the stator windings as the rotor turns. The rotor position is monitored by the Hall Effect sensor which supplies

information to the electronic controller and based on this position, the stator windings to be energized is determined. These electronic drive consist of IGBTs (2 on each phase) which operate motor drive.

For obtaining the rotor position a Hall Sensor is embedded on the stator. As motor rotates, the hall sensor senses the position and develops a high or low signal, depending on the poles of magnet. Control voltage is implemented by microelectronic device has several high-tech choices. This may be implemented using a microcontroller.

Speed control of BLDC motor is essential for making the motor work at desired rate. Speed of BLDC motor can be controlled by controlling the input DC voltage. The higher the voltage , more is the speed. When motor works in normal mode or run below rated speed, input voltage of armature is changed through PWM model. When motor is operated above rated speed, the flux is weakened by means of advancing the exciting current.



Fig.6.Solar Powered Car

A solar car is an electric vehicle powered entirely or partly by solar energy. Solar cars typically use photovoltaic cells to convert sunlight into electricity, which is then stored in batteries to power the car's electric motors. These vehicles are designed to be energy-efficient and environmentally friendly, relying on renewable energy sources instead of fossil fuels. They are often used in solar car races and showcase the potential of sustainable transportation technologies.

V. POBLEM FORMULATION

Despite the environmental benefits of electric cars, their reliance on grid electricity for charging still contributes to carbon emissions and environmental degradation. Additionally, the limited range of e-cars can be a barrier to adoption for longer commutes or recreational ride.

Our project aims to address these issues by developing a Solar Electric Car (SEC) that utilizes solar power to charge its battery, reducing reliance on grid electricity and extending its range. By integrating photovoltaic panels directly onto the car's frame, we aim to maximize energy efficiency and promote sustainable transportation solutions.

The main challenges we seek to tackle include:
 Environmental Impact: Minimizing the carbon footprint associated with electric car usage by utilizing renewable solar energy for charging.

Range Limitations: Extending the range of electric cars by supplementing grid charging with solar power, allowing for longer commutes and recreational rides.

Energy Efficiency: Maximizing the efficiency of solar panels and energy conversion systems to ensure optimal performance and minimal environmental impacts.

Cost-effectiveness: Developing a cost-effective solution that makes solar electric cars accessible to a wide range of users, promoting adoption and sustainability.

Technological Integration: Integrating solar panels seamlessly into the design of electric cars poses technical challenges related to weight, aerodynamics, and durability. Our project focuses on overcoming these challenges by optimizing the placement and design of solar panels to ensure they do not compromise the performance or aesthetics of the car.

Charging Infrastructure: Establishing a robust solar charging infrastructure is essential for widespread adoption of solar electric cars. This involves designing efficient and user-friendly charging stations that can accommodate multiple cars simultaneously while ensuring reliable and rapid charging.

Battery Technology: Enhancing the energy storage capacity and efficiency of batteries is crucial for maximizing the benefits of solar electric cars. Our project explores advancements in battery technology, such as higher energy density and faster charging capabilities, to improve the overall performance and user experience of the cars.

Our project aims to overcome these challenges through innovative design, engineering, and integration of solar power technology into

electric cars, paving the way for a more sustainable and eco-friendly future in transportation.

VI. RESULTS AND DISCUSSIONS

The implementation and testing of our Solar Electric Car (SEC) have yielded promising results, demonstrating the feasibility and effectiveness of integrating solar power technology into electric cars. The following outcomes and discussions highlight the key findings and implications of our project:

Enhanced Sustainability: By harnessing solar energy to charge the car's battery, the SEC significantly reduces its environmental impact and carbon footprint compared to traditional electric cars. The use of renewable energy sources promotes sustainability and contributes to mitigating climate change.

Extended Range: The integration of solar power technology extends the range of the SEC, allowing for longer commutes and recreational rides without the need for frequent recharging. This addresses one of the main limitations of electric cars and enhances their practicality and usability.

Optimal Energy Conversion: Through innovative engineering and design, we have optimized the efficiency of the solar panels and energy conversion systems, ensuring maximum energy capture and utilization. This results in improved performance and reduced charging times for the SEC, enhancing user experience and satisfaction.

Cost-effectiveness: While the initial investment in a Solar Electric Car (SEC)

sustainability advantages further justify the may be higher than traditional electric cars, the long-term cost savings from reduced grid electricity usage and maintenance make it a cost-effective option in the long run. Additionally, the environmental benefits and investment.

User Feedback: Initial feedback from users and testers has been positive, with praise for the extended range, environmental benefits, and overall performance of the SEC. Users appreciate the convenience and peace of mind of knowing they can rely on solar power for charging, even in areas with limited access to grid electricity.

Overall, the results and discussions highlight the significant potential of Solar Electric Cars (SECs) in promoting sustainable transportation solutions and reducing the impact of electric car usage. By harnessing the power of the sun, SECs offer a viable and eco-friendly alternative for urban commuting and recreational cycling, contributing to a greener and more sustainable future.

VII. CONCLUSIONS

The presented results as well as the design for a solar powered vehicle makes the usage of these vehicles feasible and practicable in developing countries. The solar powered electric vehicle using a PMDC motor is a good choice for the Indian market. The solar powered electric vehicle stands with higher safety, high performance as well as remains cost efficient. Use of charge controller and speed controller in the vehicle improves the efficacy of power system. The presented eco-friendly solar

powered electric vehicle can be a good choice for future generations.

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