Chapter-6

Modelling and Simulation of Solar Powered Hybrid Electric Vehicle

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Due to increase in the use of the vehicles the harmful gases are released into the environment which result in increase of pollution. So, replacing the IC vehicle is the challenging to today's world. Electric vehicle is the alternative for IC vehicles but as it cannot travel to long distance the solar Powered hybrid electric are the best to replace the electric vehicle. The solar powered hybrid electric vehicle works on both the solar energy and the energy which is stored in the battery. This project discusses about the simulation of the solar powered hybrid vehicle in which the solar energy which is extracted depends upon different parameters. In this the solar panel use the MPPT technique which extract the maximum power and the power extracted is given to boost up and drives the motor. The SIMULINK model is based on the mathematical equation. In this DC-DC converter is used to boost up and then fed to SRM.

Solar PV cell is modelled and simulated using the MATLAB. By using the MPPT algorithm maximum power is extracted. The charge controller directs this solar power to the batteries. The DC voltage from the PV panel is then boosted up using a boost DC-DC converter. This supplied power runs the SRM motor which used as to drive the motor for the vehicle application.

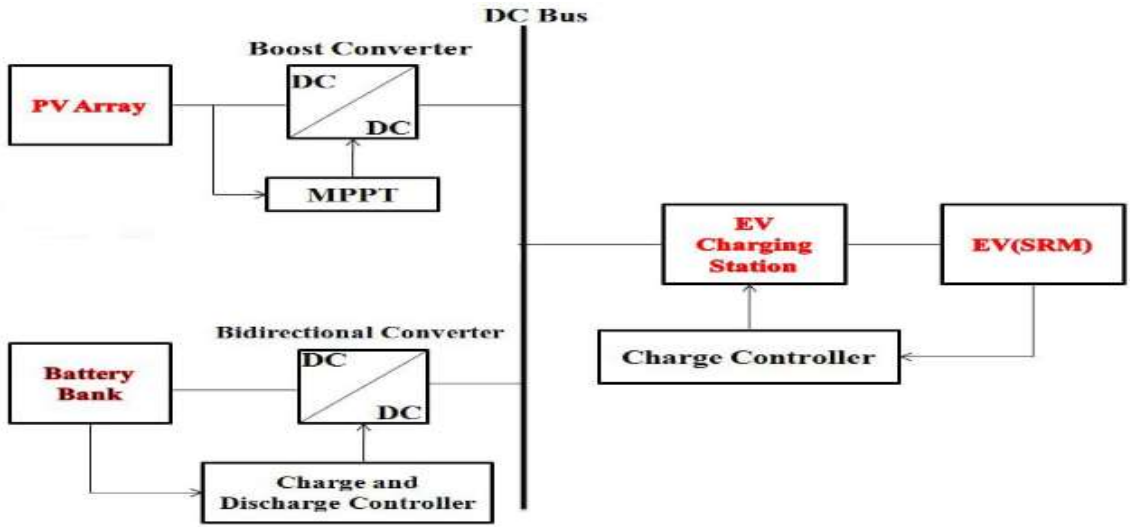

Fig.1: Block Diagram

The solar panel generates electricity from the sun and sends it to the battery for storage. The battery provides power to the electric motor, which drives the wheels of the vehicle. When the battery runs low on power, the engine kicks in to provide additional power to the electric motor and recharge the battery.

The controller manages the flow of power between the different components of the vehicle, switching between electric and gasoline power modes depending on the driving conditions. For

example, when the vehicle is driving at low speeds, the electric motor may be used to conserve fuel and reduce emissions. When the vehicle needs more power, the engine may be used to provide additional power to the electric motor. The application of using Simulink to simulate a solar-powered hybrid electric vehicle that uses both batteries and a photovoltaic (PV) panel includes:

1. Optimizing vehicle performance: Simulink provides a powerful tool for modeling and simulating the performance of a solar-powered hybrid electric vehicle under different driving scenarios.
2. Evaluating the impact of different control strategies
3. Testing the impact of environmental factors: Simulink can simulate the impact of environmental factors such as temperature, humidity, and solar irradiance on the performance of a solar-powered hybrid electric vehicle.
4. Design validation: Simulink can be used to validate the design of a solar-powered hybrid electric vehicle before it is built.

Overall, the application of Simulink in simulating a solar-powered hybrid electric vehicle allows engineers and designers to optimize the vehicle's performance and efficiency, evaluate the impact of different control strategies and environmental factors, and validate the vehicle's design before it is built.

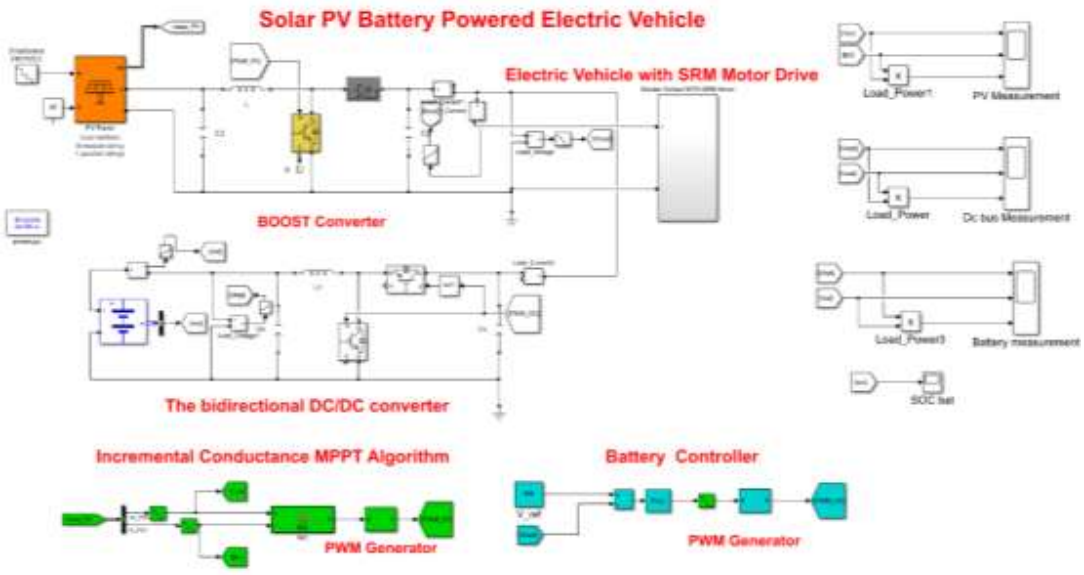

Fig:2 Simulink Model

Using different Maximum Power Point Tracking (MPPT) techniques in a solar-powered hybrid electric vehicle can improve the efficiency of the photovoltaic (PV) panel. The P&O MPPT algorithm perturbs the operating voltage and current to find the maximum power point, while the INC MPPT algorithm adjusts the voltage based on the slope of the power-voltage curve. The FLC MPPT algorithm uses a fuzzy logic controller to determine the optimal operating voltage and current of the PV panel based on input parameters. By implementing these MPPT techniques in a solar-powered hybrid electric vehicle, the efficiency of the PV panel can be optimized, the energy harvested from the sun can be increased, and the vehicle's performance can be optimized under different operating conditions.

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