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Atul Sarojwal
Department of Electrical Engineering, I.E.T., M.J.P. Rohilkhand University, Bareilly, Uttar Pradesh, India

Ashish Kumar Sankhwar
Department of Electrical Engineering, I.E.T., M.J.P. Rohilkhand University, Bareilly, Uttar Pradesh, India

Corresponding Author:
Ashish Kumar Sankhwar
Department of Electrical Engineering, I.E.T., M.J.P. Rohilkhand University, Bareilly, Uttar Pradesh, India

Solar powered electrical vehicles

Atul Sarojwal and Ashish Kumar Sankhwar

Abstract
A study on a campus-friendly solar-powered electric car is presented in this publication. Solar energy is one of the most important renewable energy sources that could be a viable substitute for fossil fuels. Sun rays emit around 800-1,000 watts of energy per square metre of the earth's surface on a bright sunny day. Why aren't we using solar energy to power our vehicles since it's pure and free? Is a solar-powered vehicle a viable alternative? The word "solar power" refers to the use of the sun's energy to power a gadget or electrical system. A grid of solar cells makes up solar panels. The sun's energy is collected and converted into electrical energy by these cells. Solar vehicles now turn sunlight into electricity, allowing them to harvest energy from the sun. This electricity powers the vehicle's motor by charging the battery. Rather than requiring a battery, some solar cars provide energy directly to an electric motor. Solar vehicles are now classified as a "green vehicle" because they are fueled by renewable energy and emit no carbon dioxide.

Keywords: solar power, solar powered electric vehicle, photovoltaic, solar cells, green energy

Introduction
Car and truck emissions are not only harmful for the environment, but they are also bad for human health. Asthma, bronchitis, cancer, and early mortality are all caused by air pollution from gasoline and diesel-powered automobiles. Localized air pollution has long-term health consequences, which manifest themselves in asthma attacks, lung damage, and cardiac issues. According to a study by specialists at the Union of Concerned Scientists, driving electric or hybrid automobiles on the grid in any state emits less greenhouse gas than driving gasoline-powered cars. The advantages of solar powered electric vehicles get stronger as states clean up their energy systems. Solar Powered Electric vehicles have the advantage of being able to be recharged almost anywhere, whether it's your on the go or home or a terminal. This makes electric vehicles an attractive option for almost all the vehicle fleet on a regular basis.

Global Acceptance
Concerns about global fuel conservation and environmental protection are growing, and electric vehicle research and development has accelerated. Digitization is causing havoc in the automotive industry around the world. Increasing automation is transforming industries for a new revolution in the twenty-first century, and the Indian automobile sector is feeling the effects. The Indian Solar Powered EV market is distinct from other global markets in that the Indian economy, market requirements, and consumer preferences are all extremely diverse.

History of Solar Vehicles
For the first time in the late 1970s, solar gadgets and electric cars were coupled. Engineers and environmentalists were under pressure from the oil crisis and began exploring for an alternate source of energy, eventually settling on solar as the best option. Hans Tholstrup organised a 3,000 km race across the Australian outback in 1987, better known as the World Solar Challenge, in which competitors were invited from industry research groups and top universities around the world, in order to generate more coverage and examine interest in solar powered transportation. General Motors won the event by a significant margin, with their Sunraycer vehicle reaching speeds of over 40 mph. In 1990, GM teamed up with the US Department of Energy to hold the GM Sunraycer as a result of their success.

Sunraycer, which is around the same duration as the World Solar Challenge, is considered a more tough race because to the more varied geography and temperatures, as well as the more problematic road surfaces and traffic congestion. In 2001, the United States held the American Solar Challenge, followed by the North American Solar Challenge in 2005, both of which are currently held every two years along various routes.

Types of Solar Powered E-Vehicles

Solar Cars

Sunlight converting to electricity for driving electric motors depends on photovoltaic cells. Photovoltaic cells immediately convert the sun into electricity, unlike solar thermal power which turns solar energy into heat. The newly introduced Hyundai Solar Car, for example, features solar panels installed on the car's roof. The power generated by PV-panels in the automobile would charge the batteries in the car.

Solar Buses

A solar bus is a bus that is powered solely or primarily by solar energy. A solar powered bus providing transport service is known as a solar bus service. Using the word solar-bus generally means solar energy is not only powering electrical equipment in the bus but also powering system for vehicle propulsion.

Tracking Vehicles

At the initial stage the solar cars were having three wheels and later on four wheels. Also solar bicycles were designed having different placements of solar panels. Some bicycles had foldable panels that could be opened at parking for charging. Some had detachable panels. These vehicles were designed to track paths as per need.

Electric Vehicle Industry in India

There are a wide variety of transportation modes that co-exist on Indian roads. Public transportation is leading the way for mainstreaming of e-mobility. Electric bicycles, scooter and motorcycle, E-Rickshaws, E-Vans, E-Bus are the solar powered vehicles that may play a vital role in transportation in coming future.

Solar Bus

Future Scope

In India, the demand for environmentally friendly electric vehicles is growing. New vehicle firms are revolutionizing the industry by developing revolutionary new models. The market for electric vehicles is rapidly developing, and new pricing models are expected to accelerate this trend.

According to energy experts, the Chinese and Indian markets will drive vehicle demand, and electric vehicle development will be high on both countries' political agendas due to lower carbon emission challenges. As the electric vehicle market grows, several companies are intending to offer charging stations for electric vehicles.

How Solar Power Vehicle Works

Because the current drawn from the grid, particularly for fast charging, can be quite substantial, electric car charging adds to the load on the energy infrastructure. Furthermore, if the charging occurs during peak hours, the owner is required to pay a large tariff premium. A PV-grid charging system is proposed to alleviate this burden. PV electricity reduces the spinning reserve capacity of the grid and increases grid stability. Furthermore, in the absence of a vehicle, PV-generated electricity can be sold to the grid for a profit. Figure 2 depicts a typical PV-grid charging system configuration.

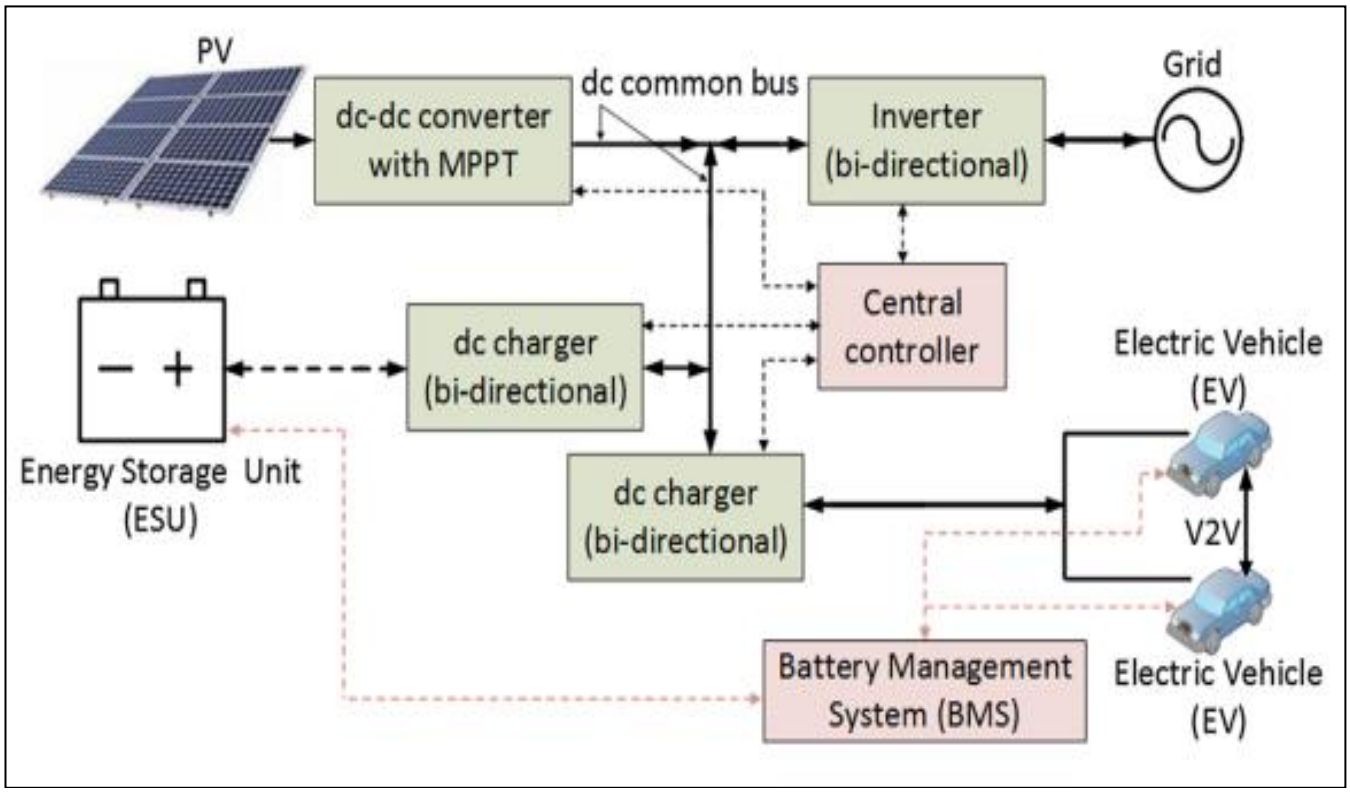
It is made up of three primary parts, namely

(1) dc–dc MPPT converter (a DC to DC power converter with an integrated MPPT),
(2) inverter that can function in both directions.
(3) DC charger that works in both directions.Furthermore, numerous academics have advocated for the usage of an energy storage unit (ESU) to maintain dc bus voltage stability.

It also compensates for renewable energy's sporadic nature. Despite these benefits, the ESU has high startup, operating, and maintenance costs. Low-cost lead acid batteries, on the other hand, can be utilised to lower the initial expenditure. Furthermore, a battery management system (BMS) can be included into the system to ensure the safety and long life of the EV or ESU's battery.

The dc common bus provides a convenient spot for all of the essential components to be integrated. Its voltage varies depending on the system, although it is often in the 200–400 V range. The dc bus can also be used as a signalling

medium, which means it can be used to send control signals throughout the system. A central controller is included in the system for centralised or decentralised coordinated charging. As shown in Figure 2, this controller collects grid, EV, PV, and ESU related data in order to make decisions about power flow direction by automatically managing the converters (without the need for an operator).



General block diagram of the PV-grid charging system

Advantages

1) Solar powered cars may use full power at any rate as opposed to normal automobiles.
2) Vehicles using solar electricity do not require any operating expenditure.
3) There are no solar vehicles.
4) Solar vehicles need relatively little upkeep.
5) No hazardous pollutants from a solar vehicle

Limitation

1) Solar cars do not have the same speed or power as conventional vehicles.
2) Vehicles powered by solar energy may only travel a certain distance.
3) If there is no sunshine,
4) The automobile battery will not charge if it's been dark for several days, and this might be an issue. This is the major cause of not relying on solar cars.
5) Good and efficient solar-powered vehicles are expensive.
6) Solar vehicle parts are expensive because they are not mass-produced in large quantities.

Conclusion

This work is aimed at designing and building a cheaper solar powered car. Following performance studies, the storage system is able to operate the solar car about 12 kilometres. The solar car's maximum speed was measured at 20 km/h. Thus, because of its less costly and nil pollution effect, solar energy vehicles are created and manufactured in this study can be utilised as green vehicules in poor nations.

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