



An Implementation of Solar PV Array Based Multifunctional EV Charger

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To Cite this Article

Allu Satyanarayana Reddy and Dr. A. Nagaraju. An Implementation of Solar PV Array Based Multifunctional EV Charger. International Journal for Modern Trends in Science and Technology 2022, 8(03), pp. 81-84. <https://doi.org/10.46501/IJMTST0803014>

Article Info

Received: 06 February 2022; Accepted: 08 March 2022; Published: 14 March 2022.

ABSTRACT

This research looks at how an electric car battery may be charged using a multipurpose EV charger supplied by a solar PV array. Two converters make up a multipurpose EV charger: a bidirectional DC-DC converter and a voltage source converter. Solar panels or the grid are used to power the electric vehicle battery charger. During high load hours, vehicle to grid operation is employed to maintain grid stability, and vehicle to house operation is also available during islanding mode. The solar PV array-based charging station should be located in an area that receives enough sunlight. For a lengthy driving range, EV charging times should be decreased and accurate battery management systems implemented. The goal of this project is to charge the electric vehicle battery and supply the residential load without interruption

1. INTRODUCTION

Global warming issues are becoming more prevalent these days, and gasoline prices are rising at an alarming rate. Because of its clean and environmentally favourable attributes, an electric vehicle attracts more attention. This study proposes a greener alternative to address basic transportation demands. When the electric vehicles equipped with energy storage devices are not in use, they can be connected to the grid to provide a large amount of energy for grid electricity. The grid's power quality is also improved by combining energy storage with distributed energy sources. An electric vehicle emits less carbon dioxide, reduces greenhouse gas emissions, and is environmentally beneficial. The battery's lifetime and charging time are the two most significant issues for an electric vehicle charging process.

The restricted driving range, long charging time, and economic features of EV technology cause concern among those dealing with the technology. Long charging times have a negative impact on the performance of rapid charging solutions, hence new gadgets are being developed to reduce charging times. Before moving further with EV technology, infrastructure for reliable EV operation, such as charging stations and EV service stations, should be in place. In EV technology, the charging station is critical, and it should be easily accessible.

This project depicts a grid-connected residential solar photovoltaic (PV)-powered domestic electric vehicle (EV) charger that serves the needs of an EV, household loads, and the grid. If a photovoltaic array offered uninterruptible charging and electricity to home uses, the charger might run on its own. The grid connected

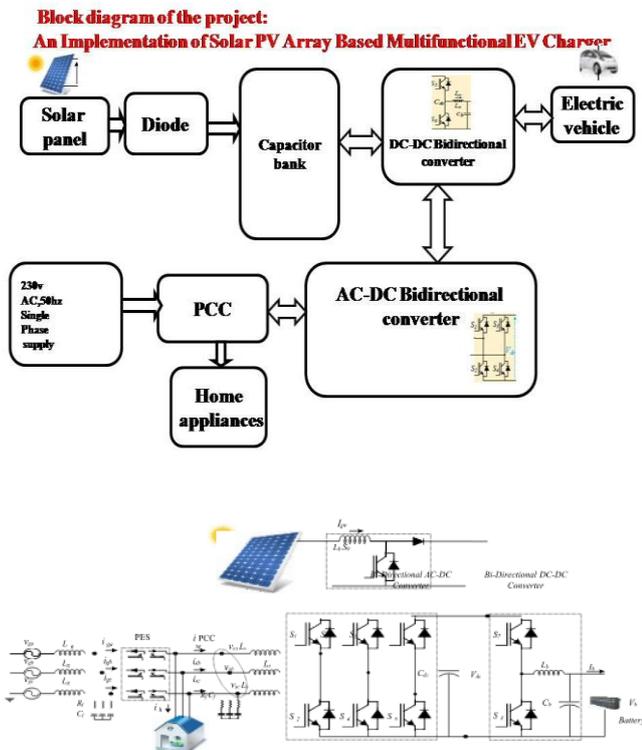
mode of operation is accessible in the absence of a PV array or when the PV array's generation is insufficient. We're employing two methods to charge the EV battery and give power to the house loads. This project involves bi-directional ac-dc grid conversion and dc-dc solar conversion.

Main features of this project:

1. By using this project we can give the uninterrupted power supply to the loads.
2. Automatic switching of modes.
3. Low power consumption.
4. Controls high Use of Renewable energy solar.
5. Long life.
6. Low cost.

The major building blocks of this project are:

- Solar panels.
- Capacitor bank
- DC-DC bidirectional Circuit
- DC-AC bidirectional circuit.
- EV battery.
- Home appliances
- GRID.
- * LEDs.



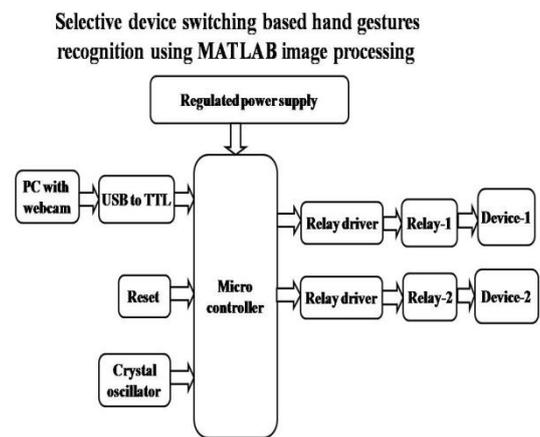
2. LITERATURE SURVEY:

The demand for the energy production is increasing because of the various reasons such as rise in the density of population ,growing economy .The demand for the production of electricity increases day by day ,but the energy resources to produce electricity are going to be extinct.

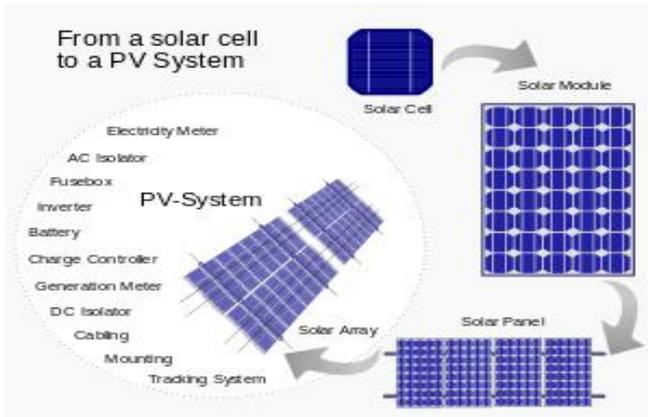
India is aggressively increasing power production ,as per IEA index 2019,INDIA 's power generation capacity is 358GW,as compared to 1998 it is four times more.

The major energy production plants in INDIA ,2\3 of total energy production ,but the major disadvantages of thermal power plants are their environment conditions and the raw material such as coal deposits are going to be extinct in the future .So most of the non-renewable power plants have these types of major disadvantages. The administration cost of one thermal power plant is equal to the administration cost of 18 wind power plants .So the production of renewable energy is increases ,in India major renewable sources are wind and solar ,the present government policy also on both of these power plants .From the last 5 years the production of energy from wind and solar is increases almost 25%.

The wind power production is easy when compared to the other non-renewable energy production ,in the production of wind energy ,the power is produced by placing wind turbine where the wind flows from high pressure energy to the low pressure energy and the occurs mainly at the hilly areas and at the sea shores.



3.SOLAR PANELS



Solar PV panels collect and convert clean renewable energy from the sun into electricity, which can then be used to power electrical loads.

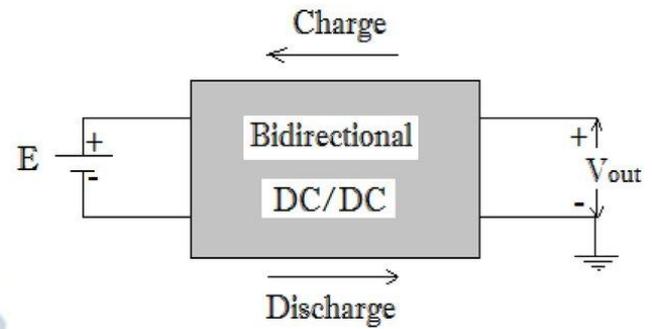
4.CAPACITOR BANK



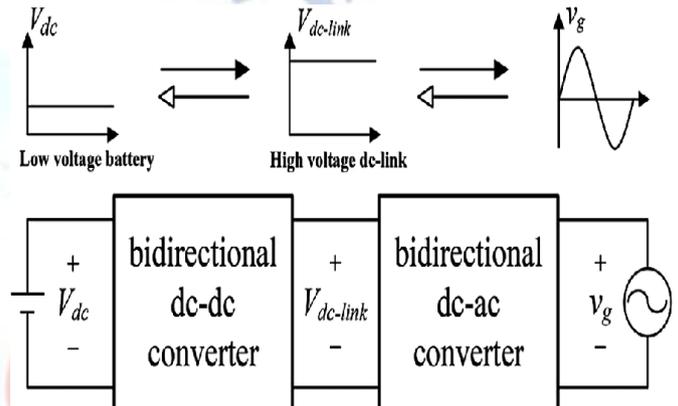
As the name implies, a capacitor bank is just a collection of capacitors of the same rating. Capacitor banks can be connected in series or parallel, depending on the required rating. Individually and in banks, capacitors are used to store and condition electrical energy.

5.DC-DC BIDIRECTIONAL CIRCUIT

Electric vehicles can employ bidirectional DC-DC converters to switch between energy storage and use. The Bidirectional DC-DC can simulate a non-isolated converter with two switching devices or an isolated converter with six switching devices.



6.DC-AC BIDIRECTIONAL CIRCUIT



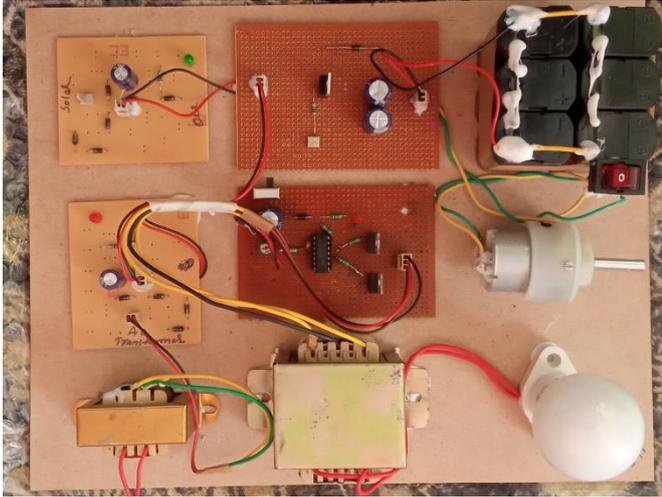
This system's foundation is the energy transfer between a DC voltage source and an AC voltage source, and vice versa. To make the converter, a DC-AC stage is connected in order. The purpose of the DC-DC stage is to create a rectified sine wave.

7. EXPERIMENTAL PROCEDURE :

A multi-purpose EV charger based on a solar PV array can serve as a vehicle to grid, vehicle to home or grid to vehicle. The suggested gadget will operate as an active power filter to reduce grid current harmonics. During the power exchange, the THD is within the IEEE 519 standard's limits.

The topology of the given system is shown. It is made up of a single-phase bi-directional dc-dc converter that connects the battery of the electric car directly to the DC bus. Grid hookups are handled by a single phase VSC. A solar PV array-based EV charger is utilised for multifunctionalities such as EV charging from PV and grid, V2H operation, and V2G operation. EV charging will take place when there is adequate PV irradiance; if there isn't enough PV irradiance, the EV will be charged from the grid. During peak hours, it will discharge from the battery to the electric grid and for domestic usage. The output of the bidirectional DC-DC converter is

connected to the EV battery. The DC-DC converter on this charger can handle a range of duties. When charging the EV battery, the DC-DC converter is in buck mode, and when draining the EV battery, it is in boost mode. The coupling inductor connects the grid to the chosen charger. A coupling inductor is necessary to minimise harmonics and smooth the grid current.



8. CONCLUSION

A multipurpose EV charger based on a solar PV array is shown in this paper. A solar PV array, a linear load, and a grid are all part of the system, and they're all regulated by IGBT switches with correct control mechanisms. The circuit is simplified because solar PV charging is done directly without the usage of a boost converter. We can do both charging and discharging with this proposed topology. As a result, this charging system satisfies the needs of residential loads, electric vehicles, and utilities. According to these test results, This charger is doing its job of charging electric vehicles, serving local household loads, and assuring grid power quality. The charger is also configured to function as an active power filter, ensuring that grid current has a unity power factor and less than 5% total harmonic distortion .

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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