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Wireless Charging of E-Car by Natural Electricity Generator (Solar Energy)

M. Sai Kumar[1], Aakansha Dande[2],Robin Dongra[3] , Abhishek Sharma[4]

[1] M. Sai Kumar Electrical - D Y Patil Institute Of Engineering & Technology , Ambi
[2] Aakansha Dande Electrical -D Y Patil Institute Of Engineering & Technology , Ambi
[3]Robin Dongra Electrical – D Y Patil Institute Of Engineering & Technology , Ambi

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Abstract – Within the past decade, since impediments in Nonrenewable fuel sources and the contamination they cause, utilization green energies, such as those that are sun-oriented, in tandem with electric vehicles, is a developing slant. Coordinating electric vehicles (EV) charging stations with sun-powered boards (PV) reduces the burden of EV Charging on the control framework. This Paper presents a literature review on remote control transmission framework for charging the batteries of electric vehicles utilizing sun-based boards as a source of power generation. The goal of this research is to advance knowledge in the wireless power Transfer (WPT) framework and explore more about solar-powered electric vehicles charging stations. To do this, a variety of solar-powered electric vehicle charging station types are thoroughly studied. Following a study of many framework elements, the types of WPT components are explored in a different section. Within the wireless power transmission framework for solar-powered electric vehicle charging, compensators and various coil structures are also investigated, along with the advantage of each coil over the others. This study also discusses the use of artificial intelligence (AI) in WPT framework and highlights the important aspects of
Developing an AI model.

Key Words: Wireless Power Transmission, Electric Vehicle Charging, Photovoltaic System, Artificial Intelligence , Solar Energy.

1.INTRODUCTION

Due to the growing demand of consumers worldwide, the need for electricity generation has increased. At the same time, rising natural gas prices and regulatory emphasis on limiting greenhouse gas emissions have increased the cost of generating electricity using fossil fuels. Because of this, there has been an increase in the usage of alternative energy sources for providing electricity, such as the solar power produced by solar systems. Utilizing EVs is another action to take to reduce air pollution. However, it needs to be taken into account that they only go a short distance on a single charge. Electric vehicles require charging stations for their batteries, as was previously mentioned. The most common and secure method of charging an electric vehicle is with a wire connected to the grid; however, the focus of this article is on the use of renewable energy sources, such as solar power, as a power generation source for wireless power transfer (WPT) technology. To avoid the drawbacks of using cables for charging, WPT can also be employed The structure of the charging stations, as well as their problems and potential solutions, are discussed in the following.

Figure 1 illustrates the general state of charge of an electric car wirelessly using a photovoltaic panel Solar cells and the controller section are two of the most crucial parts of the charging station. It is not feasible to obtain the maximum power from the solar panels at the output, due to weather conditions, shadows, the location of the sun according to the solar panel, and other variables. However, we can obtain and transmit the maximum power from the solar cells to the output by using maximum power point tracking (MPPT) algorithms.

The Perturb and Observation (P&O) method, which compares the voltage and current in every moment and the moment before and chooses the optimal value, is one of the most common and straightforward approaches in this subject. Another important component is converters, which can change the voltage level to the desired value. It falls into two broad groups, DC–DC and DC–AC converters, both of which are important. The best and most widely used converter is the buck/boost converter.

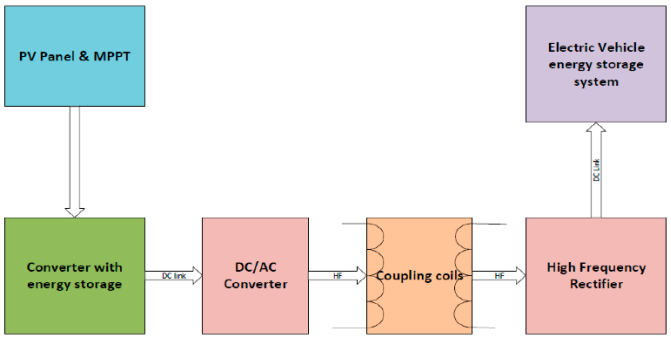

Fig -1: Overview of wireless Charging powered by a Solar Panel

As previously mentioned, the losses that impact the system's efficiency are the main problem with power transmission; hence, several resonates are utilized to

create resonances, and the best of them is LCC resonance. Using various coil structures—which can be referred to as a circular structure, instead of the standard ones—is another technique to increase system efficiency, and after performing the above process, we can raise efficiency up to 90%. After transferring power to the secondary coil, an alternative voltage, that is, DC, is required. To accomplish this task, due to the high-frequency system, a high-frequency rectifier is required. Next, the voltage must be changed to a suitable voltage for the energy storage used in EVs. For EVs, lithium-ion (Li-ion) is frequently used, as it has a higher power density than lead-acid or nickel-cadmium rechargeable batteries. A DC–DC converter can be employed to do that. We can then wirelessly charge EVs using a solar panel after completing this method. Solar energy and electric cars may be utilized to minimize air pollution, which is a highly serious issue in recent years, owing to air pollution and the limited supply of fossil fuels [5]. Additionally, due to their limitations in storing energy and traveling short distances, electric vehicles need charging stations to be able to provide the energy required for electric vehicles to travel long distances. There are many ways to charge an electric vehicle, known as AC and DC charging modes. Table 1 summarizes the types of charges available for electric vehicles. Since there are several sorts, each of which needs cables and unique converter heads to charge, technology has advanced to the point where it is now possible to transmit electricity wirelessly, as is covered below.

Table -1: Electrical Quantities & types of Charging Methods

Charging Type	Voltage of Nominal AC supply(V)	Maximum Power(KW)	Charging Time (h)	Place of the Charger
Level 1-AC	120	1.3-1.9	20-22	1-phase, On-Board
Level 2-AC	240	Up to 19.2	6-8	1 or 3-phase, On-Board
Level 3-DC	208-600	50-150	0.2-0.5	3-phase, Off-Board

2. Wireless Charging Station for Electrical Car Using Solar Energy

In general, all types of charging stations will be divided into two distinct categories: static and dynamic. However, first, a look at solar systems is had before discussing different kinds of charging stations.

2.1. The Solar Power Generation System

According to Figure 2, a solar system has three primary components, and an energy storage system would make it four if we included it:

- Photovoltaic array;
- DC–DC converters;
- MPPT system;
- Energy storage system.

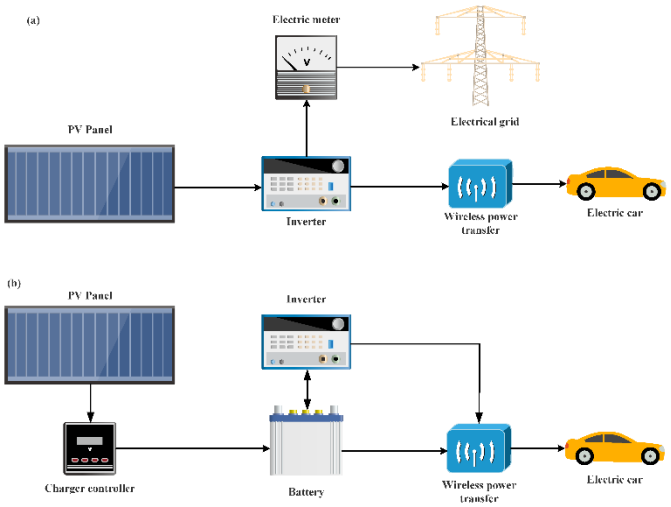

Fig -2: Overview of a Grid-Connected Photovoltaic System **(a)** and Off-grid system **(b)**

The phenomenon by which the radiant energy of the sun is converted into electricity without the use of mechanical mechanisms is called the photovoltaic phenomenon. In general, photovoltaic systems are classified into two groups, according to their application: grid-connected units and off-grid units.

2.1.2. DC–DC Converter

Converters play a major role in the photovoltaic system, which is responsible for changing the voltage and current to the expected value. DC–DC converters can be divided into two types of reducers and boosters. The aid commands the switches to turn on and off, and the circuit operates to reach the expected voltage level. Figure 3 represents the electrical circuit of the buck converter:

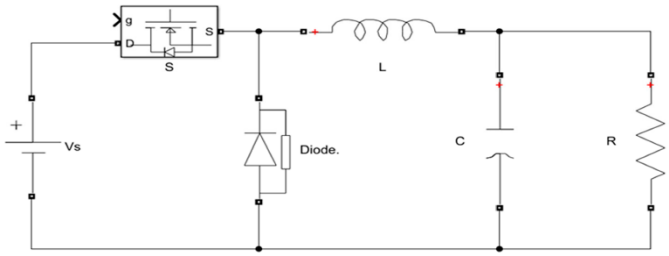

Fig -3: Bunk Converter coil

Plug-in or battery electric vehicles (BEVs) suffer from two major problems—cost and range. To increase the range of distance with fully charged electric vehicles, they must be charged continuously or often need to install a larger storage unit (which leads to additional problems such as cost and weight). Additionally, a common charging method for EVs is not cost-efficient; so, for the problem, we can use a dynamic wireless charging system for electric vehicles (D-WEVCS), which is known as an "electric road". Research shows that this method can reduce the problem range and cost of electric vehicles. Primary coils are positioned and spaced in the road with a high voltage, high frequency AC source, and compensation circuits to the microgrid and/or renewable energy system (RES). The secondary coil similar to static-WEVCS is located below the car and is used to receive the magnetic field generated when electric vehicles (EVs) pass the transmitter. Then, the magnetic field is converted to the DC charge by the power converter BMS. The Possibility of frequent charging of electric vehicles reduces the storage unit size; the need is almost 20%, compared to the current EVs. The dynamic wireless charging station system is similar to the static one, with the difference being that the number of transmitter coils is usually more than in the static mode. Therefore, all of the static charging station system's stages apply to the dynamic station, as well. A dynamic wireless charging station for electric cars using solar panels is shown in **Figure 4.**

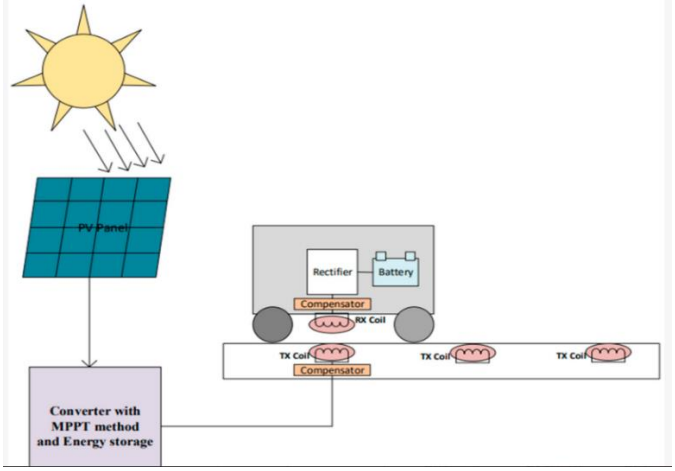

Fig -4: Basic diagram of dynamic wireless electric vehicle charging system.

3. Application of Artificial Intelligence in WPT

There are several studies on the WPT system that focus on the goal of achieving higher distance transmission. The research has mainly focused on impedance adaptation and the design of resonators, transducers, and power electronics and inverters with appropriate control methods According to the needed performance, which varies depending on the application, WPT systems were constructed. They can be used in many different ways; for example, small coils can be useful in biomedical applications, while medium-sized coils are suitable for wireless charging, and larger coils are made for charging electric vehicles. The types and dimensions of the winding affect the power transmission efficiency and lead to other various changes in different parameters, such as mutual inductance, resonance frequency, and so on. Trial and error exercises are time-consuming when calculating parameters, and the outcome may not be altered from a theoretical, simulation-based, or computational standpoint.

4. Recommendations and Future Work

Today, due to the growth of using electric vehicles, the need for charging EV stations has increased, in which one of the sources that can be used in charging stations is a photovoltaic system, and we also discussed that the best method for charging electric vehicles is wireless method, which can be improved by using the following suggestions:

(1) Using wireless charging during vehicle movement, which will reduce the cost of energy storage units
(2) Improving wireless power transmission by using new coil structures and using new resonances suitable for improving power transmission.
(3) Applying the new MPPT algorithm or combine several algorithms to improve solar panel output energy.
(4) Using new converters or a combination of existing converters that can be used for this type of system.
(5) Creating a wireless charger that can quickly charge a vehicle, compared to the time it takes to do so using a plug-in charger.
(6) More consideration and study must be given to enhancing shielding, in order to promote health and safety.
(7) Employing quantum computing methods for better power transmission with more precision and speed.
(8) We need to find innovative methods to reduce the cost of materials (especially for the dynamic charge method).

5. CONCLUSION

This paper presents and investigates current technologies for wireless charging electric vehicles with solar energy. Due to the fact that WPT technology and solar energy use are reliable, practical, and effective charging techniques, they are currently the subject of intensive research in academia and industry. In this review paper, we explored electric cars and the type of charging modes. According to the discussions, when more electric vehicles are produced, the photovoltaic system may offer a promising energy source to power them.

The method of generating electricity from solar energy and the general classification of photovoltaic systems are divided into two groups, grid-connected and off-grid, and the parts used for this purpose were discussed. Additionally, MPPT approaches were studied, and the P&O method was frequently picked for the MPPT algorithm, due to its straightforward implementation and excellent accuracy. We looked at and evaluated various storage technologies, including lithium-ion batteries, which are frequently used in electric cars due to their compact size, light weight, and high efficiency. EV connection types to the grid and static and dynamic wireless charging techniques were also explored.

This paper also examined the development of wireless power transfer, as well as its various forms and uses. To improve the critical elements in wireless power transmission, we also reviewed the crucial elements in power transmission and looked at various coil and compensator structures, as well as the important factors and shielding effect in WPT.

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