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WIRELESS ELECTRIC VEHICAL CHARGING SYSTEM USING SOLAR

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ABSTRACT -The need for effective, environmentally friendly, and user-friendly charging methods has grown due to the quick expansion of electric vehicles (EVs). An inventive way to charge electric cars without the use of physical wires or connectors is the Wireless Solar Car Charging System, which blends solar energy generation with wireless power transmission technology. This approach seeks to decrease carbon emissions, encourage the use of renewable energy sources, and lessen reliance on traditional fossil fuels. Solar photovoltaic (PV) panels, a battery energy storage unit, power conditioning circuits, wireless power transmission coils, and a charging control system. Solar panels capture sunlight and convert it into electrical energy, which is stored in batteries or directly supplied to the wireless charging unit. The wireless charging mechanism operates on the principle of electromagnetic induction or resonant inductive coupling, where power is transferred from a transmitter coil installed on the ground to a receiver coil mounted underneath the vehicle. This enables safe, efficient, and contactless charging of electric vehicles. One of the major advantages of wireless solar charging is convenience. Users do not need to handle charging cables, reducing wear and tear, maintenance requirements, and safety risks associated with exposed electrical connections. The integration of solar energy further enhances the sustainability of the charging process by utilizing a clean and renewable energy source. This reduces the burden on the electrical grid and lowers operational costs over time technological advancements are focused on improving efficiency, reducing costs, and enhancing the reliability of wireless charging systems.

I. INTRODUCTION

In reaction to the depletion of resources, electric cars are considered an alternative. Wireless power transfer (WPT) is taken into consideration as a battery charging option since practical and dependable ways to charge EV batteries are crucial to increasing the usage of EVs in daily life. This project involves the design and implementation of a wireless charger prototype system with an operating

frequency of 60 kHz. The necessity for a cable and plug charger, galvanic separation of the on-board electronics, the size and expense of this charger, and the requirement for large energy storage system (ESS) packs are all obstacles for plug-in electric vehicles (PEVs). However, by utilizing the wireless charging chance provided by the wireless charging technology. Customers find it convenient, and it has built-in electrical isolation and control. road charging. The main objective of our project is to design and develop an antenna system suitable for vehicle using resonant magnetic coupled wireless power transfer technology to electric vehicle charging systems. Application of WPT in EVs provides a clean, convenient and safe operation. At the core of the WPT systems are primary and secondary coils. These coils construct a loosely coupled system where the coupling coefficient is between 0.1-0.5. In order to transfer the rated power, both sides have to be tuned by resonant capacitors. The operating frequency is a key selection criterion for all applications and it especially affects the dimensions of the coils and the selection of the components for the power electronic circuit.

A Resonant wireless transfer system for vehicle charging technology is designed. Transmission of power without wires for supplying power to electrical devices and equipment, and for charging has been contemplated since the times of Tesla. However, this was not possible at that time because associated enabling technologies were not available. A breakthrough to this end was achieved in 2007 when researchers lit up a bulb from a wireless power source at a distance of two metres . Much advancement in this field has been made since this major success . Electric vehicle (EV) charging is one of the many other areas where the option of wireless power transfer (WPT) has good potential and is being actively explored due to its many advantages. The traditional wired or plug-in charging systems are also called conductive charging systems. There are a few problems associated with these wired charging.
systems. For example, they require heavy charging wires and connectors. Furthermore, the charger should be manually connected to the electrical supply and the device to be charged . The wired charging system is also not user and environment friendly . If there is a short circuit or breakdown of the insulation of the charging wire due to reasons, such as high temperature, friction with the ground or the charging device itself, then this can cause an electric shock which can be fatal. To reduce the charging time, and hence potential hazards associated with it, a large number of batteries can be used or the drained batteries can be swapped with the if a vehicle can run a certain distance in a single charge with a given number of batteries, then the travel range can be increased by using a higher number of batteries. Alternatively, the vehicle batteries can be swapped with the charged batteries at charging stations during travel. However, the batteries have their own set of problems .

The batteries have heavy weight and a high initial cost but short life. Due to their weight, it may not be possible to carry a large number of batteries beyond a certain number. Future innovation in the energy storage devices may help overcome these problems. However, another possible method to overcome the problems associated with the batteries is the WPT . For example, heavy and large size batteries can be avoided and the initial cost can be reduced by using the dynamic wireless power

charging system . Furthermore, the WPT method is convenient and user friendly as it removes the hassle of wires and connectors associated with the manual plugged in charging systems . WPT and its practical implementations are being widely investigated due to their potential use in a variety of industrial and engineering applications. Some of the applications where WPT can be used include EVs, electronic gadgets
, industrial plants , underwater vehicles , lighting , implanted medical devices , solar powered satellites , unmanned aerial vehicles (UAV) and smart grids . The WPT has also been investigated for long distance power transmission in the grid . A grid connected wireless power transmission system has been deployed as well, and is being tested .

II. LITERATURE SURVEY

The wireless solution is increasingly spreading as a method of battery charging for Electric Vehicles (EVs). The standard technology of wireless EV battery charging is based on the Inductive Power Transfer (IPT) between two coupled coils, one connected to the electrical grid and the other one connected to the rechargeable battery. The IPT provides benefits in terms of safety and comfort, due to the absence of a plug-in operation: through IPT, the electrocution risk typically arising from power cords is avoided and the battery charging operation can automatically start. According to the state of the EV, there are mainly two types of IPT for the wireless charging: static IPT, when the vehicle is stationary and nobody is inside it (e.g. in a parking area); dynamic or quasi-dynamic IPT, when the vehicle is being used (e.g. while in motion or during the traffic red light). The wireless power transfer obviously represents the only solution for the dynamic charging, since the wired connection would be impossible during the motion. In spite of the undeniable advantages brought by Inductive Power Transfer, the researchers have to deal with several issues in order to make this technology even more attractive for the EV market. First of all, an IPT system is inherently less efficient in terms of power transfer efficiency if compared to a conventional wire-based system. Indeed, due to the magnetic coupling between the coils, there is an unavoidable minimum leakage magnetic field, leading to an energy loss. Furthermore, some technical aspects need to be taken into account in the practical implementation of an IPT system: for example, in order to obtain the maximum coupling, the misalignment between the coils must be as small as possible. As far as safety is concerned, even if the IPT allows to reduce the electrocution risk, some care is required regarding the magnetic field exposure. Mankind has been using automotive vehicles for transportation from one place to another. These vehicles use internal combustion(IC) engines to drive it. Due to increased number of vehicles there is environmental pollution caused by IC engines and reduction in fossil fuels. The latest innovations in the Automotive Industry are helping to improve fuel efficiency and reduce emissions. One such technological advancement is Hybrid vehicles which use both IC engines and electric motors to drive the vehicles or a car in simple words, helping to reduce the amount of emissions produced maintaining the performance of the engine. However, in the future, the focus is on clean and green energy producing zero emissions. Design and manufacture of electric vehicles has led to

major interest in current industry . Since these vehicles run on battery the main drawbacks are high cost, short

III. OBJECTIVES

The need for effective, dependable, and ecologically friendly charging systems has grown due to the quick expansion of electric vehicles (EVs). Traditional charging techniques rely heavily on grid electricity, which may come from non-renewable energy sources, and need actual wires. The idea of a Wireless Solar Car Charging System has surfaced as a creative way to get around these restrictions. This technology offers a clean, practical, and sustainable way to charge electric automobiles by combining solar energy generation with wireless power transfer (WPT) techniques.

3.1 To Utilize Renewable Solar Energy Effectively

One of the primary objectives of the wireless solar car charging system is to harness solar energy and convert it into electrical energy for charging electric vehicles. Solar energy is abundant, renewable, and environmentally friendly. Photovoltaic (PV) panels capture sunlight and convert it into electricity without producing harmful emissions. The use of solar power helps reduce dependence on conventional electricity generated from fossil fuels such as coal, oil, and natural gas. By utilizing solar energy, the charging system contributes to sustainable energy development and supports the transition toward clean energy solutions. This objective is particularly important as global energy demands continue to rise and concerns about climate change increase. Furthermore, solar-powered charging stations can be installed in remote areas where grid connectivity is limited, thereby expanding access to electric vehicle charging infrastructure.

3.2 To Implement Wireless Power Transfer Technology

Another important objective is to develop a wireless charging mechanism that eliminates the need for physical charging cables. Wireless power transfer technology operates on the principle of electromagnetic induction, where energy is transferred from a transmitting coil to a receiving coil through a magnetic field.

This objective focuses on making the charging process more convenient and user-friendly. Drivers only need to park their vehicles over a charging pad, and the charging process begins automatically. The elimination of cables reduces wear and tear, minimizes maintenance requirements, and enhances overall system reliability. Wireless charging also reduces the possibility of connection failures caused by damaged charging ports or cables. This technology is particularly beneficial in public charging stations where frequent use can lead to equipment degradation.

3.3 To Improve User Convenience and Accessibility

The wireless solar charging system aims to provide a seamless and convenient charging experience for electric vehicle owners. Traditional charging methods often require users to manually connect and disconnect charging cables, which can be inconvenient, especially during adverse weather conditions. Wireless charging simplifies the entire process by allowing automatic energy transfer once the vehicle is correctly positioned over the charging pad. This ease of operation encourages more people to adopt electric vehicles.

IV. RESEARCH METHODOLOGY

Inductive power transfer method for charging The primary side, which transmits electricity, and the secondary side, which receives power, are the two major components of a conventional IPT system. The secondary side of an IPT-based EV charging system is mounted on the moving vehicle, while the primary side of the system may be positioned on or beneath the road. Power is transferred from the primary side to the secondary side. The power source is mostly determined by the application or the device's power needs. A single or three phase system can be utilized if the device is power-hungry, however modest batteries can be adequate if the gadget's power needs are low. coil of an IPT system takes place due to the mutual coupling between the two coils. A physical contact between the EV and the charger is not required in an IPT system, as coupling technique with a small gap between the coils is used for the wireless transfer of power.

The research methodology is a systematic process used to design, develop, implement, and evaluate the Wireless Solar Car Charging System. The purpose of this methodology is to investigate the feasibility of integrating solar energy generation with wireless power transfer technology for charging electric vehicles (EVs). As the demand for sustainable transportation continues to grow, renewable energy-based charging systems have become an important area of research. Wireless charging eliminates the need for physical charging cables, while solar energy provides a clean and renewable source of power.

4.1 Research Objectives

1. To create a wireless charging system for electric cars that runs on solar power.
2. To investigate how solar photovoltaic panels function in different environmental settings.
3. To create a wireless power transmission system that is effective.
4. To assess the suggested system's charging efficiency.
5. To examine energy losses that happen when transmitting wirelessly.
6. To make charging more convenient by doing away with electrical connections.
7. To encourage the transportation sector to utilize renewable energy sources.
8. To assess how well wireless charging performs in comparison to traditional charging techniques.

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V. RESULT

The Wireless Solar Car Charging System combines solar photovoltaic (PV) energy generation with wireless power transfer (WPT) technology to provide a sustainable and convenient method for charging electric vehicles (EVs). The objective of this project is to reduce dependence on conventional grid electricity, improve charging convenience, and promote the use of renewable energy sources. The system consists of solar panels, a charge controller, battery storage, wireless power transmitter and receiver coils, and an electric vehicle battery.

5.1 Solar Photovoltaic System Performance

The solar photovoltaic subsystem serves as the primary energy source for the charging system. Solar panels convert sunlight into electrical energy, which is then utilized for battery charging through the wireless power transfer system.

During simulation, the PV module was tested under varying solar irradiation levels ranging from low sunlight conditions to peak sunlight conditions. The results indicated that the power output of the solar panels increased proportionally with solar irradiance.

- At low irradiance levels, power generation was lower but sufficient for maintaining charging operations.
- At medium irradiance levels, the charging rate increased significantly.
- At peak sunlight conditions, maximum power generation was achieved.
- The photovoltaic system maintained stable voltage output throughout the charging cycle.

5.2 Solar Panel Performance Analysis

The solar energy system exhibited excellent operational stability. Maximum output power was achieved during daytime operation, allowing efficient charging of the battery storage unit.

Advantages observed include:

1. Continuous renewable energy generation.
2. Reduced dependence on conventional electricity.
3. Low maintenance requirements.

5.3 Wireless Power Transfer Analysis

Wireless power transfer technology enables energy transmission without direct electrical contact. The transmitter coil generates an alternating magnetic field, which induces voltage in the receiver coil placed beneath the vehicle.

The system utilizes inductive coupling for power transmission. Performance was evaluated under different distances and alignment conditions.

VI. CONCLUSION

The Wireless Solar Car Charging System effectively illustrates how wireless power transfer technologies and sustainable solar energy may be combined to charge electric vehicles. The initiative tackles major issues with traditional charging methods, including reliance on grid energy, problems with cables, and environmental issues. The concept encourages clean and sustainable energy use while lowering carbon emissions by using solar photovoltaic panels as the main energy source. Solar panels, an energy storage unit, a charge controller, and a wireless power transfer mechanism make up the created system, which allows car batteries to be charged contactlessly. Performance analysis and experimental testing demonstrate the system's ability to efficiently gather solar energy, store it efficiently, and transfer power wirelessly to charge a battery. Although some energy losses occur during wireless transmission, the overall system demonstrates satisfactory performance and feasibility for practical applications.

The project highlights the potential of combining renewable energy technologies with modern charging solutions to support the growing adoption of electric vehicles. It offers improved user convenience, enhanced safety, and reduced maintenance compared to traditional wired charging systems. Furthermore, the system contributes to the development of sustainable transportation infrastructure and aligns with global efforts to reduce dependence on fossil fuels.

In conclusion, the Wireless Solar Car Charging System is a promising and environmentally friendly solution for future electric vehicle charging applications. With further improvements in wireless charging efficiency, battery technology, and energy management systems, this technology has the potential to play a significant role in the advancement of smart and sustainable transportation systems.

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