WIRELESS ELECTRIC VEHICLE BATTERY CHARGING SYSTEM USING PV ARRAY

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***Abstract*— The primary goal of this project is to identify the operating frequency at which resonance occurs with the utility voltage gain, regardless of variations in series-series wireless power transmission systems. We have created an innovative EV charging system that allows vehicles to charge without wires, eliminating the need to stop for charging as the vehicle charges while in motion. Solar power is utilized to sustain the charging system, eliminating the requirement for an external power supply. The advancement of Wireless Power Transfer (WPT) technology in Electric Vehicle applications is progressing rapidly. Additionally, the advantages of Photovoltaic (PV) arrays are utilized, and a system is proposed to extract power from them.**

***Keywords*—** WIRELESS ELECTRIC VEHICLE, BATTERY, BOOST CONVERTER, LCD DISPLAY, ATMEGA 328 MICROCONTROLLER, SOLAR PANEL.

1. INTRODUCTION

In today's world, energy conservation is crucial, especially in the automobile sector, which plays a significant role in our daily lives. The use of biofuels in automobiles poses challenges in both energy conservation and pollution reduction. Thus, the concept of Electric Vehicles (EVs), powered by electricity, was introduced to address these issues. EVs can be used in various types of vehicles such as cars, buses, and trucks. However, a limitation arises with the EV's battery needing frequent recharging, which can be time-consuming.

Wireless Power Transfer (WPT) has emerged as a promising technology for transferring electric energy from a transmitter to a receiver wirelessly. WPT offers numerous advantages over wired connections, such as eliminating the need for carrying wires, easy charging, and smooth power transmission even in adverse environmental conditions. Wireless charging systems provide convenience and efficiency for electric vehicles, and when combined with Photovoltaic (PV) arrays, they offer a clean and sustainable energy source.

PV arrays absorb sunlight and convert it into electrical energy, which is then transmitted wirelessly through electromagnetic fields. The receiver coil in the EV captures this transmitted energy and converts it back into electricity to charge the battery. Wireless charging not only eliminates the cables required for charging mobile phones, cordless appliances, and electric vehicles but also allows for fully sealed and waterproof appliance casings. This technology enhances reliability, as it reduces the risk of mechanical damage to charging plugs or using the wrong adapters. The underlying principle of wireless charging is Faraday's law of

induced voltage, a principle commonly used in motors and transformers.

2. LITERATURE SURVEY

The origins of wireless power transfer can be attributed to the pioneering work of the late Nikola Tesla, who discovered and demonstrated the principles of this phenomenon. The fundamental working principle of wireless power transfer through induction involves the transfer of power via electromagnetic induction between two objects with the same resonant frequency. When in magnetic resonance and powerfully coupled, these objects exchange energy according to the rule of magnetic resonance.

3. METHODOLOGY

Electric vehicles are gaining traction globally, not only for their environmental benefits but also for their cost-effectiveness by using electricity instead of traditional fuel. However, the major drawbacks of long charging times (1-3 hours) and limited charging stations in remote areas remain. To tackle these issues, an innovative EV charging system has been developed. This system offers wireless charging without the need for wires, enabling continuous charging while the vehicle is in motion. It integrates coils into the road surface to prevent wear and tear. Components include a solar panel, battery, transformer, regulator circuitry, copper coils, AC to DC converter, Atmega controller, and an LCD display. The system works by the solar panel powering the battery through a charge controller, storing DC power, converting it to AC using a transformer for transmission, regulating it, and then energizing the copper coils for wireless energy transfer. When the vehicle passes over the road coils, energy is transmitted from the transmitter coil to the receiver coil beneath the vehicle, where it is converted back to DC for charging the EV battery. This system, with its solar-powered wireless charging solution, demonstrates a convenient and efficient method for EV charging on the go, seamlessly integrated into road infrastructure.

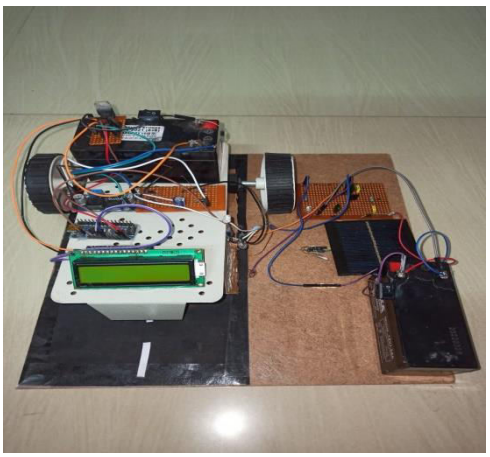

Fig.1: SOLAR BASED Wireless Electric Vehicle Charging System

COMPONENTS DESCRIPTION:

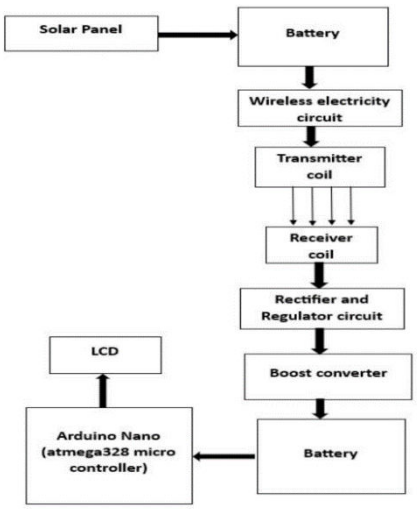

Fig.2: Block Diagram of Wireless Electric Vehicle Battery Charging System Using PV Array

4. SOLAR PANEL

The term "solar panel" is commonly used to describe a flat solar thermal collector, such as a solar hot water or air panel designed to heat water, air, or collect solar thermal energy. Furthermore, the term "solar panel" can

also relate to a photovoltaic module, which is a collection of solar cells assembled to produce energy.

. In both cases, these panels are typically flat and come in various grouping of solar-thermal panels or photovoltaic (PV) modules, which can heights and widths. An array refers to a be connected either in parallel or series depending on the specific design objective. Solar panels are commonly utilized in residential, commercial, and industrial applications to harness solar energy for various purposes.

Fig.3: Solar Thermal Panel

5. BATTERY

Types of electric car batteries:

1. Lead-acid batteries: Widely available and proven to be economical and reliable. However, concerns exist about their disposal and the need for effective pollution control during recycling. Due to their heavier weight, they are not as portable.

2. Nickel metal hydride batteries: These have a higher energy density compared to lead-acid batteries, around 69.4Wh/kg. They have been utilized in various all-electric plug-in vehicles like the Toyota RAV4 EV, General Motors EV1, and Honda EV Plus, as well as in hybrid vehicles such as the Toyota Prius and Honda Civic Hybrid. They generally have a lower environmental impact than nickel-cadmium batteries due to the absence of toxic cadmium. Industrial nickel is often recycled due to its high value.

3.Lithium-ion batteries: Widely preferred for electric vehicles due to their superior range per charge and lower cost compared to nickel-metal hydride batteries. Lithium-ion batteries have a low discharge rate of approximately five percent per month, significantly lower than the 30 percent per month of nickel-metal hydride batteries. To extend the lifespan of lithium-ion batteries, they should be charged early and often, never allowed to drop below their minimum voltage, and kept cool.

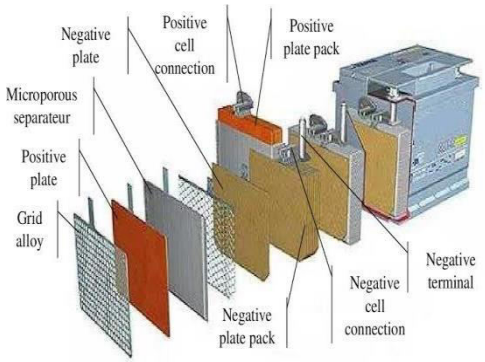

Fig.4: Lead Acid Battery

6. BOOST CONVERTER

One kind of DC-DC converter that effectively ramps up voltage levels is the boost converter. It is essential for applications requiring a steady, elevated voltage, such as LED drivers or battery-powered devices, because its output exceeds its input. It has two modes of operation: continuous and discontinuous, and its power efficiency and versatility make it highly valued.

Fig.5: Boost converter

7. LCD

An electrical display module with many uses is the LCD (Liquid Crystal Display) screen. A 16x2 LCD display is a relatively basic module that is frequently seen in many different kinds of circuits and devices. Compared to other multi-segment LEDs particularly those with seven segments, these modules are preferable. The reasons are as follows: LCDs can display special and even custom characters (unlike in seven segments); they are inexpensive; they are easily programmable; and they can display animations and other content.

ADVANTAGES & APPLICATIONS

Advantages

- Eliminates the need for physical contact between the EV and EV and the charging infrastructure.
- Reduces wear and tear on charging connectors, increasing their lifespan.
- Enables automatic and seamless charging, improving user experience and convenience**.**
- Pollution free

Applications

- Wireless EV charging systems using PV arrays are already in use in some residential and commercial settings .Ongoing research and development aim to improve efficiency, affordability, and scalability.
- Integration with smart grid technologies and vehicle-to-grid (V2G) capabilities hold significant potential for the future.

RESULT

The wireless EV charging system with a PV array offers convenient, efficient, and sustainable charging. It eliminates the need for physical connections and relies on solar energy, reducing reliance on traditional grids and carbon emissions. Challenges include lower efficiency compared to wired methods and susceptibility to weather conditions

PARAMETERS:

S.NO	INPUT CONDITION	OUTPUT
1	COIL LESS THAN 100	WIRELESS MODE
2	COIL GREATER THAN 100	BATTERY MODE

- It offers the convenience of wirelessly charging the EV without the need for physical connections.
- The PV array harnesses solar energy, making it a renewable and environmentally friendly charging option. It reduces reliance on traditional power grids and helps decrease carbon emissions. However, there are some challenges to consider
- The charging efficiency of wireless systems can be lower compared to wired methods, and weather conditions can affect the charging performance. It's an exciting concept, but further advancements are needed to optimize its practicality and efficiency

CONCLUSION

The integration of a wireless electric vehicle (EV) battery charging system with a photovoltaic (PV) array

offers a convenient, efficient, and sustainable solution. simplifying charging for EV owners. Solar energy harvested by the PV array provides a clean, renewable power source, reducing reliance on traditional grid electricity and lowering carbon emissions. The direct coupling of the PV array with wireless charging minimizes energy losses, while excess energy can be stored for later use. Overall, this innovative technology represents a significant step towards a greener and more sustainable transportation ecosystem.

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