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Solar Wireless Electric Vehicle Charging System

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ABSTRACT: The solar wireless electric vehicle (EV) charging system represents a pioneering integration of renewable energy and advanced wireless power transfer technology to address the growing demand for sustainable transportation solutions. This innovative project aims to develop a robust and efficient system that harnesses solar energy to wirelessly charge electric vehicles, thereby eliminating the need for cumbersome charging cables and enhancing the convenience and accessibility of EV charging. The successful implementation of this system has the potential to revolutionize the EV charging infrastructure by providing a cleaner, more efficient, and user friendly alternative to traditional wired charging methods.

I. INTRODUCTION

A Solar Wireless Electric Charging System is an innovative and sustainable technology that combines the power of solar energy with the convenience of wireless charging. This system is designed to charge electronic devices or electric vehicles (EVs) without the need for physical connectors, making it a cleaner and more user-friendly alternative to traditional charging methods. The system primarily consists of solar panels, a charge controller, a battery storage unit, an inverter (if needed), and a wireless power transmission module. Solar panels capture sunlight and convert it into electrical energy, typically in the form of direct current (DC). This energy is then regulated by a charge controller to ensure safe and efficient power flow. The regulated energy can either be stored in a battery bank for later use or directly used to power the wireless charging module.

The wireless charging process works on the principle of inductive coupling, where a transmitter coil generates a magnetic field, and a receiver coil (embedded in the device or vehicle) picks up this field and converts it back into electrical energy for charging. This technology eliminates the hassle of plug-in charging and reduces wear and tear on charging ports. Additionally, since the system is powered by solar energy, it significantly reduces dependency on grid electricity and minimizes the carbon footprint, contributing to a greener and more sustainable future. Such systems are especially useful in remote areas or smart cities, where renewable energy and automation play a crucial role in modern infrastructure. In large-scale applications, such systems can be implemented in public parking areas, highways, and smart homes, significantly contributing to the reduction of fossil fuel use and promoting the adoption of electric transportation.

II. LITERATURE REVIEW

1. Bugatha Ram Vara Prasad, M. Geethanjali, M. Sonia, S. Ganeesh, P. Sai Krishna
Summary: The : This paper describes the design of solar powered charging station for charging of electric vehicle describes design of solar powered charging station for charging of electric vehicle that solves the key downside of fuel and pollution. Electric vehicles have now hit the road worldwide and are slowly growing in numbers. Apart from environmental benefits electric vehicles have also proven helpful in reducing cost of travel by replacing fuel by electricity which is way cheaper. Well here we develop an EV charging system that solves with a unique innovative solution.
2. Ayush Sen, Bhuvan Sharma, Darshan Ranka, Drishti Gupta, Yusuf Sharif Summary: The Face Recognition The paper describes about the dynamic electric vehicle charging system from solar. It reduces fuel and pollution. Nowadays electric vehicle are growing in numbers because of high rates of fuel Electric vehicle has now hit the road worldwide and are slowly growing in numbers. Also it is proven that electric vehicle helpful in reducing cost of travel and which is cheaper than fuel. So we have developed an electric charging system with unique ideas for solving charging system problem. In this electric vehicle no need of any wire, no need of external power supply, no need to stop vehicle for charging, we can charge EV in moving condition. In this system we use, battery,

transformer, Atmega controller, LCD display, regulatory circuit, solar panel, coils of copper, AC to DC converters to develop the system more accurate. This whole system describes that how an electric vehicle can be charged in moving condition and also eliminating the need to stop the vehicle and charge it.

3. O.P. Suresh, Salava V Satyanarayana , P Hema Bindu , K Anan , N Srujith Kumar , V Sujith
Summary: The automotive industry has undergone a transformation with the growing popularity of electrical vehicles, which provide an eco-friendlier and cleaner substitute for conventional fuel-powered cars. However, the scarcity of EV charging stations is impeding the widespread use of electric vehicles. This research offers a novel wireless EV charging technology that runs on solar energy as a solution to this problem, providing EV owners worldwide with affordable and environmentally friendly options. The wireless power transmission technology at the centre of the suggested system allows EVs to charge without the need for physical hookups. This technology improves user accessibility and safety while doing away with the need for cords. By using solar energy, one can lessen their reliance on traditional power sources increasing the cost- and environmentally-effectiveness of the charging. Comparing this strategy to the conventional plug-in EV charging techniques reveals a number of benefits. The system's ability to charge electric vehicles (EVs) while they are in motion further improves user convenience and reduces discharge time. Solar power offers a sustainable and renewable energy source, minimizing reliance on the power grid and environmental impact. Wireless charging also eliminates the need for physical connections, improving safety and convenience. The purpose of this study is to solve the shortcomings of the conventional electric vehicle systems and offer an innovative solution that will further the development of sustainable transportation. The combination of solar energy and wireless charging for electric vehicles not only promotes the use of sustainable energy. It also encourages the growth of an energy ecosystem that is more flexible and interconnected, paving the path for more environmentally friendly and effective city transport in the future.
4. Kiran Raj L, Nagachandra M A, Nikhil M P, Pankaj Rastapur, Bhanu H S, Sahana M S
Summary: The design of a solar charging station for electric cars is thoroughly explained, along with how it solves the two main problems of fuel and pollution. There are more and more electric cars on the roads today. Electric cars have proven to be effective in lessening the travel cost by switching from fuel to EV's, which is much less expensive, with the environmental benefits. However, in this case, we are developing a charging system for electric cars that provides a unique, solution. There are no cables involved, solar energy is used to maintain the charging system, and no external power source is required. The vehicles can be charged while they are moving. The development of the system involved the use of LCD Displays, batteries, solar grid, control circuits, primary and secondary copper coils, AC to DC converters, Atmega processors and inverters. The system uses solar panel for power the battery through the charge controller, then the battery will store DC power. That DC power is converted into AC for transmission. The technique demonstrates how electric automobiles can be recharged while being driven, eliminating the need to stop for recharging. The technology demonstrates how an integrated wireless solar charging system for EV is used.

III. METHODOLOGY OF PROPOSED SURVEY

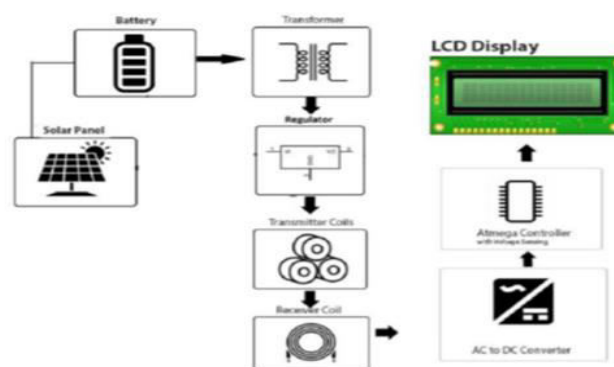


Fig1. Block Diagram

The hybrid Solar and AC Grid-based Wireless EV Charging System utilizes both solar and conventional power sources for efficient vehicle charging. Solar panels generate DC power, while the AC grid power is stepped down via a transformer, converted to DC, and regulated before both sources feed a common battery. This battery powers the transmitter coil, which wirelessly sends energy to the EV's receiver coil using high-frequency electromagnetic waves. A voltage sensor monitors the received energy, and a microcontroller manages system operations and displays real-time data on an LCD. The system offers a clean, wireless, and intelligently controlled solution for sustainable EV charging.

Hardware Description

The Solar Wireless Electric Vehicle Charging System integrates a combination of renewable energy harvesting components and wireless power transmission modules. The hardware setup is meticulously designed to ensure efficient energy generation, management, and contactless power delivery to an electric vehicle. The key hardware components are described below:

1. Arduino Nano:

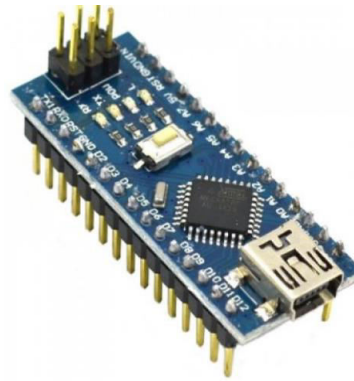


Fig2. Arduino nano

An Atmega microcontroller is the brain of the system. It monitors voltage levels, coil alignment, and charging status. It also controls system operations and displays real-time data on an LCD screen.

2. LCD Display:



Fig3. LCD

A 16x2 or 20x4 LCD is used to display vital system parameters such as charging status, battery voltage, and error messages (e.g., misalignment or low power). This provides user-friendly feedback and enhances system transparency.

3. Battery:



Fig4. Battery

A rechargeable lead-acid or lithium-ion battery is employed to store the solar energy. This stored energy allows the system to operate continuously, even during periods of low sunlight or at night. The battery output serves as the power source for the wireless transmission circuit.

IV. FLOWCHART

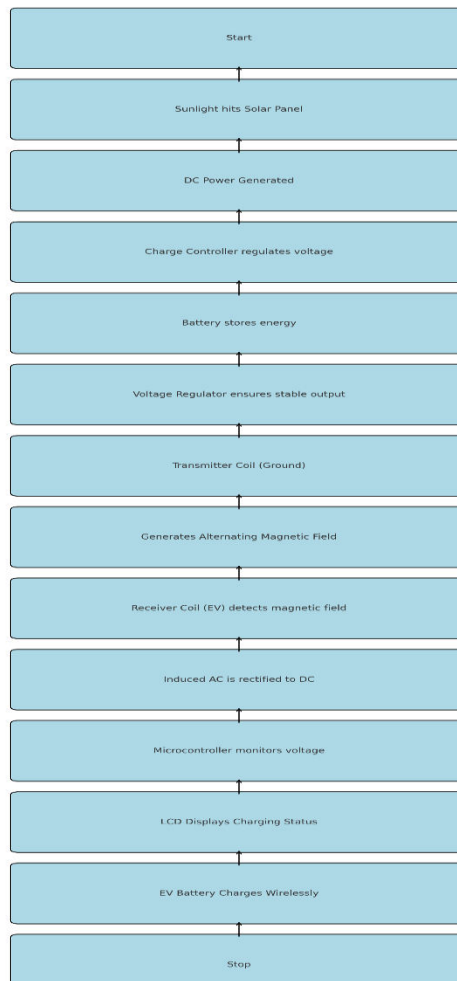


Fig5. Flowchart

V. RESULT

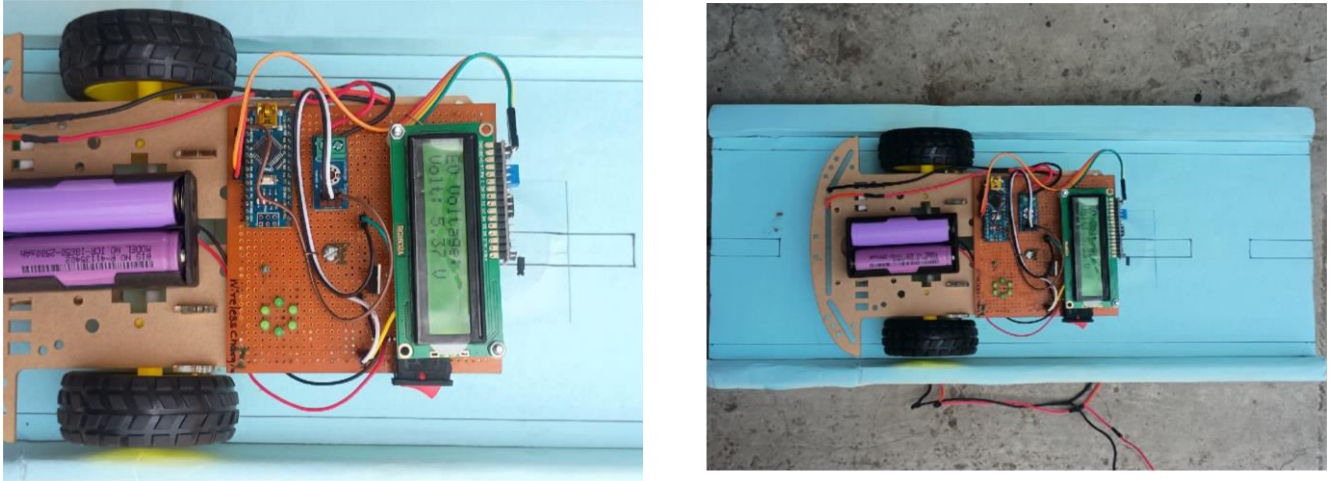


Fig2. Results.

The Solar Wireless EV Charging System was successfully developed and tested, confirming the feasibility of wireless power transfer using solar energy. Under optimal sunlight, the solar panel generated 18–20V, which was regulated and stored in a battery via a charge controller. The transmitter coil then produced a stable magnetic field, effectively transferring power to the EV's receiver coil when properly aligned. This induced AC voltage was converted to a smooth DC output (11.5V–12.6V) using a rectifier and filter, suitable for charging 12V EV batteries. The Atmega microcontroller monitored voltage levels and displayed real-time charging status on the LCD, enhancing system usability and reliability.

VI. CONCLUSION AND FUTURE SCOPE

Conclusion:

The Solar Wireless Electric Vehicle Charging System developed in this project successfully showcases the integration of renewable energy and wireless power transfer (WPT) as a forward-thinking solution for sustainable transportation. This system eliminates the limitations of traditional plug-in chargers by providing a convenient, contactless charging method that can operate through inductive coupling. The use of solar panels ensures clean energy generation, reducing carbon emissions and promoting environmental sustainability. The system was designed using key components such as a solar charge controller, transmitter and receiver coils, a rectifier circuit, an Atmega microcontroller, and a display unit, all of which were integrated and tested in real-world scenarios.

Future scope:

The future scope of solar wireless electric vehicle charging systems is promising and multifaceted. Here are several key areas of development:

- a) **Increased Efficiency:** Ongoing research into advanced materials and technologies, such as high-efficiency solar panels and better wireless power transfer methods, could significantly enhance energy capture and conversion rates.
- b) **Infrastructure Development:** As adoption grows, there will be a need for widespread infrastructure, including solar charging stations integrated into urban environments, highways, and parking lots, making charging more accessible and convenient.
- c) **Smart Grid Integration:** Integrating these systems with smart grids can optimize energy distribution, manage demand, and allow for vehicle-to-grid (V2G) capabilities, enabling EVs to return stored energy to the grid during peak times.

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