SOLAR WIRELESS ELECTRIC VEHICLE CHARGINING SYSTEM

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***Abstract*—Electric vehicles(EVs) are growing in popularity as a result of an increasing demand for clean, sustainable transportation. To charge EVs, the traditional method has been through public and private sector infrastructures that support plug-in, grid-dependent charging. Unfortunately, using a grid-connected, plug-in, electrical vehicle charging infrastructure is inconvenient, time consuming, and dependent on an electric grid that is often not a clean source of energy. In order to address these issues, this project proposes the use of an Electric Vehicle Charging System that operates wireless and solar energy (PV). PV panels convert solar energy to DC electrical energy, which is then stored in a battery, and distributed to the EV via wire- less power transfer (such as electromagnetic induction/resonant inductive coupling) from a transmitter coil powered by a solar- charged battery to the receiver coil attached to the vehicle. This system reduces the demand for fossil fuels and eliminates the use of wires to charge EV batteries, while also providing a safe and efficient way to charge batteries. This project uses WPT/Wireless Power Transfer technology and renewable energy to create a pathway for the development of green transportation and smart charging infrastructure. EV Charging Systems in the proposed project design will not only be eco-friendly and cost-effective, they can also be readily integrated into the existing public and private; parks, roads, highways, and smart city infrastructures that are key to the development of future EV mobility solutions.**

I. INTRODUCTION

The Solar Wireless Electric Vehicle Charging System of- fers an environmentally friendly solution for electric vehicle charging through its combination of solar power generation and wireless charging capabilities. Electric vehicles (EVs) provide an effective method to decrease carbon emissions while decreasing reliance on fossil fuels because of the world- wide demand for sustainable transportation solutions. Electric vehicle (EV) users experience significant difficulties because they must deal with the charging restrictions which come with standard plug-in charging systems. The system depends on physical connectors which need regular upkeep and need users to operate them, which results in operational problems and

electrical dangers that decrease system usability. Researchers and engineers want to develop wireless charging systems which provide secure battery charging through contactless technology that improves user security and comfort. The project uses solar panels as its main energy source to produce . clean renewable energy through direct sunlight capture. Solar

energy gets transformed into electrical energy, which becomes stored in an appropriate energy storage solution that provides power during times of insufficient sunlight. The system uses inductive coupling to wirelessly transmit stored energy from the power source to the electric vehicle. The system uses inductive coupling, which requires a transmitter coil to be situated at ground level while the vehicle uses a receiver coil. The transmitter coil generates a magnetic field when an alternating current flows through it, which creates a voltage in the receiver coil. The EV battery receives charge through induced voltage, which enables charging without any physical connection between the charger and the vehicle. The process of charging through cables becomes safer because it eliminates all physical charging cables which make electrical shock hazards possible through connector degradation and electric shock dangers.

The system requires specialized roadways for its operational functions. The development of this technology enables elec- tric vehicles to achieve greater driving distances because it eliminates battery-related issues. The Solar Wireless Electric Vehicle Charging System operates as an environmentally sus- tainable transportation solution which supports the transition to green energy systems. The system supports worldwide initiatives which aim to decrease greenhouse gas emissions and increase the use of renewable energy sources. The system creates an economical and efficient upcoming electric vehicle solution through its integration of solar power with wireless charging systems. The project demonstrates that contactless solar charging technology works because it can develop into a new EV charging system which will become essential in the future. The technology will develop into a fundamental element of contemporary transportation systems according to ongoing research and development because it will help create an environmentally sustainable and intelligent future.

II. PROJECT OBJECTIVE

1. Reduce dependency on fossil fuels and grid electricity by using solar energy.
2. Provide wireless charging to avoid cables and improve user convenience

3. Enable charging of vehicles even while moving on roads (dynamic charging).

4. Promote eco-friendly transportation and support the development of smart cities.

5. Enhance charging efficiency through optimized coil design and effective power transfer technology.

6. Ensure safety and reliability by implementing proper control, monitoring, and protection mechanisms during charging.

III. LITERATURE SURVEY

"A Solar-Integrated Wireless Charging System for Electric Vehicles"
Authors: Harpreet Kaur Channi,Meena Malik,Hsing-Chung Chen. Authors create a wireless charging system for electric vehicles using solar energy to generate electric power using photovoltaic panels, MPPT control and resonant inductive power transfer; the wireless charging system converts solar energy into regulated electric energy and wirelessly transmits the energy through magnetically-coupled coils, maintaining extremely high levels of efficiency when the coils are misaligned or the sunlight is variable. By providing a solar powered wireless charging system for electric vehicles, the solar-powered wireless charging system reduces reliance on the electrical grid, increases convenience to the consumer and creates a more sustainable electric vehicle charging infrastructure.
"Solar-Powered Wireless Dynamic Charging System for Electric Vehicles"
Authors: Mrs. Sterlin Rani D, Ashwini P, Haritha J C, Subhashri S This author presents a wireless dynamic solar powered charging system to allow an electric vehicle to charge while the vehicle is in motion. Using inductive coupling from the transmitter coils embedded in the road to the receiver coils on the vehicle, the energy is continuously transferred to the vehicle. Some of the benefits outlined throughout the paper are: extended driving range; reduced battery size; lower maintenance; and promoting sustainability in transportation.
"State-of-the-Art Research on Wireless Charging of Electric Vehicles Using Solar Energy"
Authors: Seyed Ali Kashani, Alireza Soleimani, Ali Khosravi, Mojtaba Mirsalim Cutting-edge Study for New Way to Charge Electric Cars: Solar Powered Wireless Charger for Electric Vehicle" has been done by Seyed Ali Kashani, Alireza Soleimani, Ali Khosravi and Mojtaba Mirsalim. The review article focuses on developments such as various system designs, configuration of coil, compensation strategies, and how to control all those components to provide a wireless EV charging system. The comparison of wireless electric vehicle charging between each other was done in this article and various hybrid combinations were compared for a solar/grid dependable system to provide reliability. Based upon the data from the study, the integration of wireless charging EVs with solar energy will provide a sustainable, scalable and environmentally sustainable way of providing an EV charging system for the future.

IV. BLOCK DIAGRAM

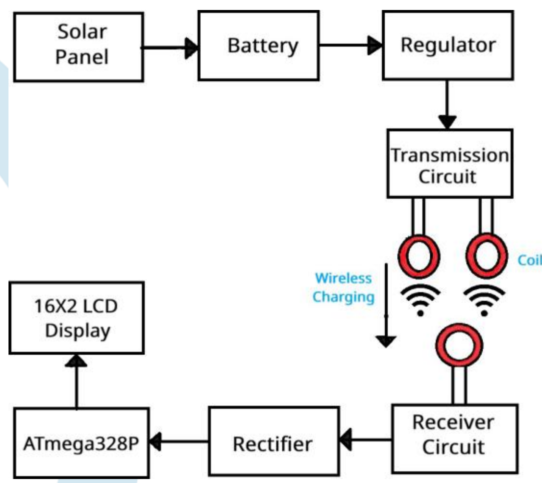


Fig. 1. Basic Block Diagram

V. COMPONENTS

Solar Panel:
A solar panel consists of photovoltaic cells, mainly made of semiconductor materials like silicon, which convert sunlight into electricity through the photovoltaic effect. These cells produce direct current (DC) when exposed to sunlight as excited electrons move to create an electric current. Structured as flat, rectangular panels with an array of cells in rows and columns, solar panels are used for generating electricity in residential, commercial, and industrial settings, as well as for charging batteries in solar-powered devices.Systems are essential for providing power to remote locations or during emergencies.

Fig. 2. Solar Panel

Battery:

Batteries store electricity produced by solar energy and provide reliable power for wireless transmission. Even when there is no sun, the battery continues to supply power enabling the unit to operate continuously. Lithium-ion batteries are typically used due to their high energy density, extended lifespan, and high level of reliability. The DC electricity that is stored in the battery is converted to high-frequency AC electricity to operate the transmitter coil and transfer wireless power. At the vehicle end, the energy received is rectified and transferred to charge the EV battery safely. A battery management system monitors the voltage, current and temperature of the battery to ensure safety and the efficiency of the overall system.

Fig. 3. Battery

Regulator:

A DC to DC booster, or step-up converter, is an electronic circuit that increases the voltage level of a direct current (DC) power supply. It takes a lower voltage input and boosts it to a higher voltage output, utilizing switching components like transistors and inductors to efficiently regulate the voltage.

Rectifier:

Fig. 4. Regulator

ATmega328P:

The ATmega328P is an 8-bit microcontroller that is specif- ically designed for low power consumption and is com- monly used in embedded control applications, particularly during the development of AVR-based

MOSFET-based rectifier is commonly used to accommodate variations in input voltage and frequency. Active rectification reduces conduction losses and improves power conversion efficiency compared to conventional diode-based designs. An LC filter is applied at the rectifier output to suppress ripple and provide smooth DC voltage. This configuration enhances charging stability, efficiency, and reliability under varying operating conditions.

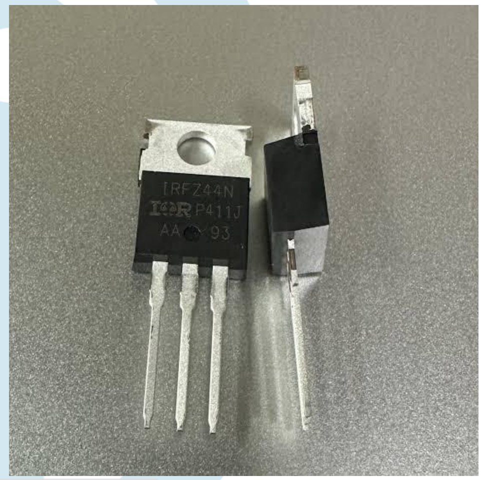


Fig. 5. Rectifier

projects. It runs at a maximum of 20 MHz, and supports a data memory of 32 KB Flash (program memory), 2 KB SRAM (data memory), and 1 KB EEPROM (non-volatile storage). In addition to this memory support, the ATmega328P has many different integrated peripherals and hardware functions such as 10- bit Analog to Digital Converters (ADCs), timers/counters, Pulse Width Modulation (PWM), Universal Asynchronous Re- ceiver/Transmitters (UARTs), Serial Peripheral Interface (SPI), and Inter-Integrated Circuit (I²C). The combination of low power consumption and multiple sleep modes makes the AT- mega328P an excellent choice for applications where energy efficiency is important. Another advantage of the ATmega328P A high-efficiency rectifier is employed to convert the received alternating current into a stable direct current suitable for battery charging. A full-bridge diode rectifier or an active

is its reliable delivery of real-time control and simple inter- facing with various types of sensors, power electronics, and different forms of communication.

Fig. 6. ATMEGA328P

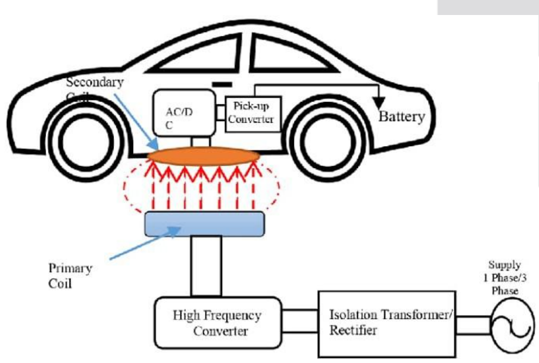
16 x 2 LCD Display:

A Liquid Crystal Display (LCD) uses liquid crystal technology to create visible images, resulting in thin, lightweight displays commonly used in laptops, televisions, smartphones, and hand- held gaming consoles.

Fig. 7. LCD Display

VI. CONCEPT DIAGRA

Fig. 8. Concept Diagram



RESULT

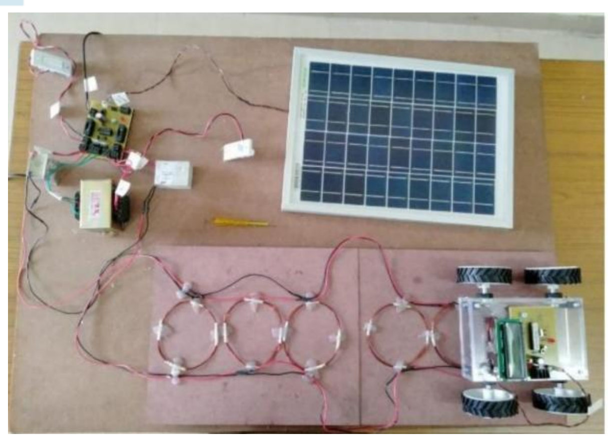


Fig. 9. Result

VII. FUTURE SCOPE

Solar-based wireless charging systems for EVs are one area in which there seems to be ample opportunity for future progress. With increased penetration of EVs, these devices can allow users to reduce their reliance on existing power sources (through use of renewable solar energy). As technol- ogy advances, future solutions will enable the improvement of wireless power transfer through better coil design, improved resonant circuits, and more efficient power electronics. The potential for future development of smart sensors and IoT- type technologies to support vehicle detection, intelligence automated control of charging,and optimal energy usage repre- sents another area of future direction. Large-scale installations of solar-powered wireless charging systems at parking lots, highways, and public charging stations could create conve- nience, improved environmental stewardship, and long-term sustainability for electric vehicle users.

VIII. REFERENCES

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2. A Solar-Integrated Wireless Charging System for Electric Vehi- cles Harpreet Kaur Channi, MeenaMalik, Chin-Ling Chen, Hs- ingChungChen, Ramandeep Sandhu, Chander Prabha Febru- ary 2025, ETASR Proposed system with PV + WPT; includes Simulation results.
3. State-of-the-Art Research on Wireless Charging of Electric Vehicles Using Solar Energy Seyed Ali Kashani, Alireza Soleimani, Ali Khosravi, Mojtaba Mirsalim Published 27 December 2022 (Energies) A survey- type paper reviewing WPT + solar EV charging, coil types, compensators, etc.
4. Solar Wireless Electric Vehicle Charging System Authors: Bugatha Ram Vara Prasad, M. Geethanjali, M. Sonia, S. Ganesh, P. Sai Krishna