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# Eco-Friendly EV Charging: Solar Wireless Solution

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***Abstract***
**The "Eco-Friendly EV Charging: Solar Wireless Solution" is a creative initiative aimed at making EV charging more flexible, eco-friendly, and reliant on renewable energy through wireless transfer. The system employs a 9V solar panel to capture solar energy, which is stored in a battery and transmitted wirelessly through a transmitter (TX) coil. A moving robot, representing an electric vehicle, is equipped with a receiver (RX) coil to receive the transmitted energy when in proximity. An Arduino UNO controls the system, managing power transmission and displaying real-time data on an LCD. Additionally, the robot's movement—forward and backward—is controlled via Bluetooth, allowing for remote navigation. This setup eliminates the need for physical charging connections, providing a mobile, environment-friendly EV charging option supporting modern smart transportation and renewable energy use.**

***Keywords*** **— Solar Energy, Power Supply, TX Coil (Transmitter Coil), RX Coil (Receiver Coil), Electric Vehicle, Arduino UNO.**

## I INTRODUCTION

As the demand for electric vehicles (EVs) continues to rise, the need for efficient, flexible, and sustainable charging solutions becomes increasingly important. Traditional wired charging systems limit mobility and depend heavily on non-renewable energy sources. This project introduces a "Eco-Friendly EV Charging: Solar Wireless Solution" that addresses these challenges by integrating solar energy and wireless power transmission. Utilizing a 9V solar panel, the system harvests renewable energy and stores it in a battery, which is then wirelessly transmitted to a receiver coil on a mobile robot (representing an EV).[1] Controlled by an Arduino UNO, the system ensures precise energy management and real-time monitoring via an LCD display. Furthermore, Bluetooth integration enables remote control of the robot's movement, making this project a step toward smart, eco-friendly EV charging infrastructure.

The growing concerns surrounding climate change have driven significant research and development in the field of electric vehicles (EVs) over the past decade. With rising global temperatures and increasing environmental awareness, more people are considering EVs as a cleaner alternative to conventional fuel-powered. This issue can be effectively addressed by enabling on-road charging while the vehicle is in motion, which would substantially reduce downtime and improve the convenience of EV usage. Although electric vehicles present a promising alternative to internal combustion engine vehicles, further advancements in their charging systems are necessary to position them as the primary mode of transportation in the future.[2] Dynamic wireless charging systems offer a practical solution, as they are more reliable, user-friendly, and capable of saving considerable charging time. Additionally, with continuous charging available during travel, battery sizes can be optimized, and vehicle range can be extended. Such charging infrastructure could be integrated not only along highways but also at strategic urban locations such as traffic signals, bus stops, and dedicated travel routes, contributing to the seamless operation of electric vehicles in day-to-day life.[3]

One of the primary challenges hindering the widespread adoption of electric vehicles (EVs) in India is the lack of sufficient charging infrastructure, coupled with the considerable time required to recharge vehicle batteries and the difficulty of finding suitable locations for installing charging stations along highways and urban roads. To address these obstacles, an Eco-Friendly Solar Wireless EV Charging System has been proposed. This innovative approach utilizes wireless power transfer technology powered by solar energy to charge EVs without the need for physical connections. The proposed system involves constructing solar-integrated roads embedded with transmitter coils, while receiver coils installed within the vehicle enable the battery to be charged dynamically as the vehicle moves.[4] This method significantly reduces the dependence on stationary charging stations and minimizes downtime typically spent waiting for batteries to recharge, offering a more convenient, efficient, and sustainable solution for electric vehicle users. Although electric vehicles represent an alternative, their charging infrastructure needs to be improved. [5&6] Dynamic charging systems should be created for this reason since they are more dependable, user-friendly, and time-effective. Additionally, the range can be increased while the battery size is decreased. The bus stations, traffic signals, and transit routes can all use this charging system. [7]

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## II LITERATURE REVIEW

S. Lukic, Z. Pantic [3] (2023) This paper provides an overview of wireless power transfer (WPT) technologies applied to electric vehicle charging systems. It discusses the fundamental principles of inductive coupling, system configurations, power electronics, and alignment strategies. The study highlights the potential of WPT to replace traditional wired systems, offering convenience and automation in EV charging while addressing challenges like efficiency and cost. R. Singh, M. Sharma [4] (2022) The authors propose a solar-powered EV charging station using wireless transmission technology. Solar panels are used to generate and store energy, which is then transmitted wirelessly to an electric vehicle via inductive coupling. The system is designed to reduce dependence on the grid and promote green energy. Experimental results demonstrate the feasibility of combining solar energy and wireless charging.

## III BLOCK DIAGRAM & HARDWARE

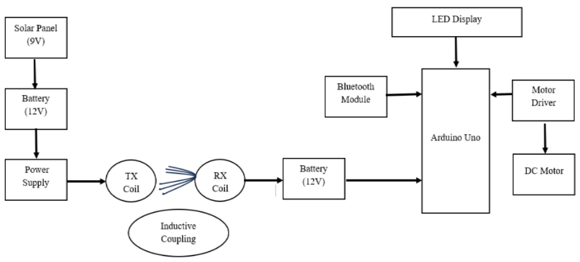


Figure1: Representation of Block Diagram

The diagram shows a solar-powered wireless charging setup for electric vehicles using inductive coupling. A PV panel captures solar energy and sends it to a charge controller for regulation. This controlled power feeds a transmitter coil, which creates a magnetic field. On the receiving end, a receiver coil picks up this energy through inductive coupling. The received power is then passed to a USB port and finally charges the battery. This method allows clean, wireless, and efficient vehicle charging without the need for physical cables

Hardware Requirements

- Arduino UNO
- Solar Panel (9V)
- Battery
- TX Coil (Transmitter Coil)
- RX Coil (Receiver Coil)
- LCD
- Bluetooth Module (e.g., HC-05)
- Motor Driver Module (e.g., L298N)
- DC Motor

Software Requirements

- Arduino IDE
- Embedded C

## IV CONSTRUCTION & WORKING

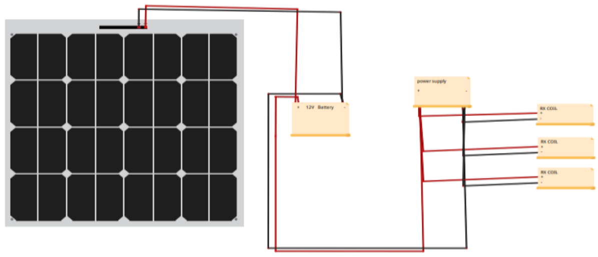

Figure 2.1: Transmitter End

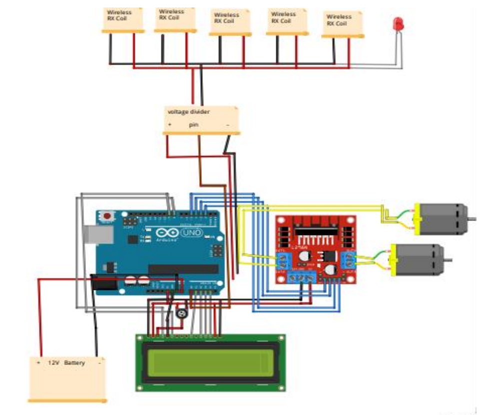

Figure 2.2: Receiving End

Figure2: Representation of Block Diagram

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Construction:
At the heart of the system is a solar panel, which serves as the primary source of renewable energy. The solar panel converts sunlight into electrical energy and sends this power to a 12V battery for storage. This battery ensures a continuous power supply to the system, even when sunlight is unavailable. From the battery, the electrical energy is routed to various key components. A voltage sensor is connected in the circuit to continuously monitor the output voltage from the battery, making sure the system operates within safe voltage levels. An Arduino Uno microcontroller acts as the brain of the system. It receives data from the voltage sensor and other connected sensors to control the entire operation. The Arduino is also connected to an LCD display, which shows real-time system parameters like voltage levels, battery status, and charging status. To manage wireless power transfer, a transmitter coil is powered by the system through a motor driver module (L298N). The motor driver helps to amplify the voltage and current supplied to the transmitter coil. On the vehicle side, a receiver coil is placed, which captures the wireless energy transmitted from the transmitter coil. Both the transmitter and receiver coils are carefully aligned to ensure efficient power transfer. The energy received by the vehicle's receiver coil is then directed to the electric vehicle's onboard battery for charging. Multiple sensors and protective circuits are also incorporated to ensure safety and efficiency.

Working:
In Eco-Friendly EV Charging: Solar Wireless Solution, the process begins when the solar panel absorbs sunlight and transforms it into electrical energy. This energy is then stored in a 12V battery, which acts as the main power source for the system. A voltage sensor is connected to the battery to keep track of its voltage level and sends this information to the Arduino Uno, which serves as the control unit. The Arduino processes this data and manages the entire system. When charging is needed, the Arduino activates the motor driver module, which controls the power supplied to the transmitter coil. This coil generates a magnetic field, which travels wirelessly through the air. A receiver coil, placed on the electric vehicle, captures this magnetic field and converts it back into electrical energy using the principle of electromagnetic induction. The recovered energy is then used to charge the vehicleâ€™s battery without any physical wires. An LCD display connected to the Arduino shows important details like battery voltage and charging status, keeping the user informed about the systemâ€™s operation. This setup presents an effective and environmentally conscious solution for charging electric vehicles wirelessly through solar energy.

## V EXISTING & PROPOSED SYSTEM

Existing system:
Current electric vehicle (EV) charging systems primarily rely on wired connections, where vehicles must be manually plugged into charging stations connected to the electrical grid. While some stations use solar energy, the integration of wireless power transmission is still limited. Existing wireless charging systems are often stationary and expensive, requiring precise alignment between the transmitter and receiver coils. Additionally, most systems lack mobility and remote-control capabilities, making them less adaptable for dynamic or on-the-go charging needs. These limitations highlight the need for a more flexible, eco-friendly solution that combines renewable energy, wireless charging, and remote-controlled mobility.

Proposed system:
The proposed system introduces a solar-powered wireless electric vehicle charging solution integrated with Bluetooth-controlled mobility. A 9V solar panel is used to harvest renewable energy, which is stored in a battery and wirelessly transmitted through a transmitter (TX) coil. When a mobile robot, simulating an EV and equipped with a receiver (RX) coil, comes into range, it receives the power for charging. The entire process is monitored and managed by an Arduino UNO, with real-time data displayed on an LCD. Additionally, the robot's movement—forward and backward—is controlled via Bluetooth, allowing remote navigation. This system enhances the flexibility, sustainability, and convenience of EV charging by eliminating wires and incorporating green energy sources.

## VI RESULTS

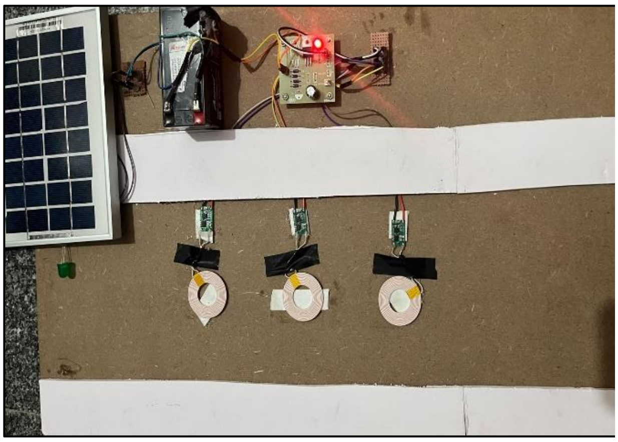

Figure 4: Transmitter End (Power R)

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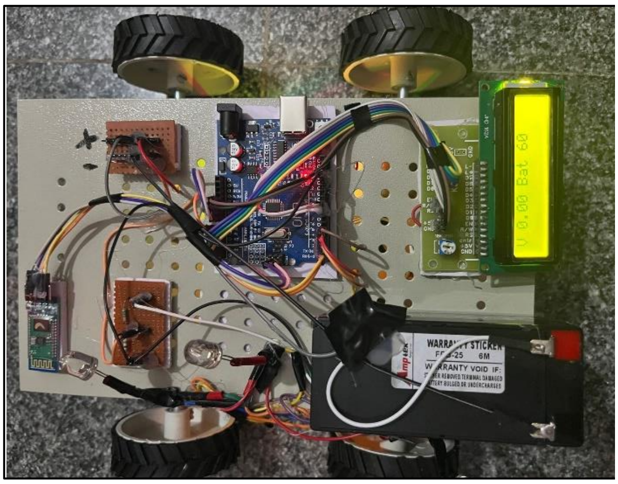


Figure 4: Receiving End (Electric Vehicle)


Figure 5: Electric Vehicle getting Charged by TX &RX

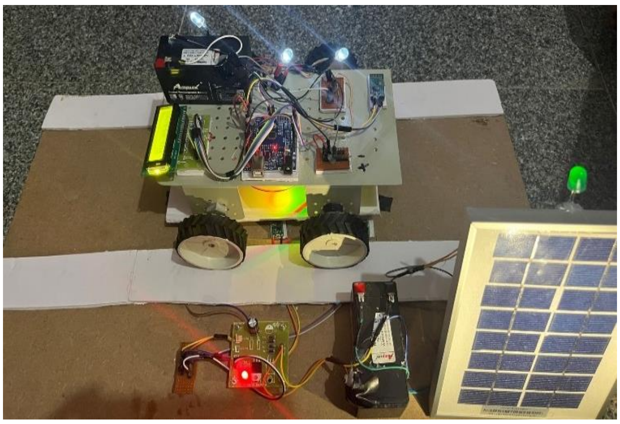

Figure 6: Representation of â€œEco-Friendly EV Charging: Solar Wireless Solutionâ€

## VII CONCLUSION

The " Eco-Friendly EV Charging: Solar Wireless Solution" presents an innovative and sustainable solution for modern EV charging needs by combining solar energy harvesting, wireless power transmission, and Bluetooth-controlled mobility. By eliminating the need for wired connections and utilizing renewable energy, the system encourages sustainable transport options while improving convenience and operational flexibility. The integration of Arduino UNO ensures efficient control and real-time monitoring, while the Bluetooth module enables remote operation of the mobile robot simulating an EV. This project not only demonstrates the potential of wireless and solar technologies in EV infrastructure but also contributes to the advancement of smart and green mobility solutions.

## VIII ACKNOWLEDGMENT

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## PROFILE DETAILS

Guide:
**Prof. Jagadeeshwar G. Shivanagutti**, born on 26th June 1986 in Kushtagi, Karnataka, holds a B.E. in Electrical Engineering from PDACE, Gulbarga, and an M. Tech in Energy Systems and Management from SJCE, Mysore. He is currently an Assistant Professor at Tontadarya College of Engineering, Gadag. His interests include Energy Conservation, Solar Energy, Energy Management, and Electric Vehicles. He has guided several UG projects and published numerous papers nationally and internationally. He is a lifetime member of IAENG, the Institute of Scholars, and IFERP. He also serves as a nominated faculty under the NISP Implementation Program by MHRD Innovation Cell. His accolades include the InSc Best Teacher Award 2019, Best Project Award by KSCST Bengaluru, and 1st Prize in a national slogan competition on Solar Energy.

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