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"Solar Wireless Electric Vehicle Charging System"

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Abstract: Electric vehicles (EVs) are gaining traction globally as a sustainable solution to transportation needs, promising reduced reliance on fossil fuels and lower emissions. However, the challenge of convenient and eco-friendly charging infrastructure persists. This project addresses this challenge by introducing a dynamic electric vehicle charging system powered by solar energy.

The system leverages a 12V solar panel to harness renewable energy, converting it into electrical power for charging EV batteries. What sets this system apart is its wireless transmission technology, enabling continuous charging while the vehicle is in motion. This eliminates the need for external power sources or stopping for charging, enhancing the convenience and efficiency of EV usage.

Central to the system's operation is the Arduino UNO microcontroller unit, which manages the charging process and ensures optimal energy transfer. Real-time data on charging status and performance are displayed on a 16 X 2 LCD display, providing users with valuable insights.

Key components such as the DC converter, transmission circuit, and copper coils are integrated seamlessly to facilitate efficient charging. This integration not only ensures a smooth charging experience but also underscores the system's sustainability and environmental friendliness.

In summary, this project presents a holistic solution to the challenges of EV charging infrastructure. By harnessing solar energy and employing wireless transmission technology, it offers a sustainable, efficient, and convenient charging option for electric vehicle users, ultimately contributing to a greener and more sustainable future.

Keywords: Solar Energy, Wireless Charging, Electric Vehicle, Arduino UNO, DC Converter, Transmission Circuit, Sustainable Charging, Dynamic Charging System

I.INTRODUCTION

The rise of electric vehicles (EVs) signals a promising shift towards sustainable transportation, offering a solution to combat climate change and reduce reliance on fossil fuels. However, challenges persist in the charging infrastructure, with conventional stationary charging stations causing significant waiting times for vehicle owners. This hinders the seamless integration of EVs into mainstream transportation systems. To address this issue, our project aims to develop an innovative solution: the Solar Wireless Charging System in Electric Vehicles. By harnessing solar energy and wireless transmission technology, this system revolutionizes the EV charging landscape, enabling on-the-go charging to minimize downtime and enhance overall efficiency. Traditional charging systems are static, requiring vehicles to park at designated stations for extended periods, leading to increased waiting times, limited infrastructure availability, and grid integration challenges. Integrating renewable energy sources is crucial to facilitate widespread EV adoption. Earlier research focused on improving battery technologies but lacked renewable energy integration. Recent efforts have attempted to integrate solar power with EV charging, but most remain stationary, necessitating vehicle stops for charging. Developing an efficient solar wireless charging system requires specialist knowledge in solar power generation, wireless transmission, and electric vehicle design. Stakeholders include EV owners, manufacturers, urban planners, environmentalists, and government agencies focused on clean energy and transportation.

II.PROJECT OBJECTIVE

1. Develop a solar-powered wireless charging system for electric vehicles, utilizing Arduino Uno microcontroller and necessary hardware components.
2. Design the system to efficiently convert solar energy into electric power using a DC to DC converter and a set of batteries for energy storage.

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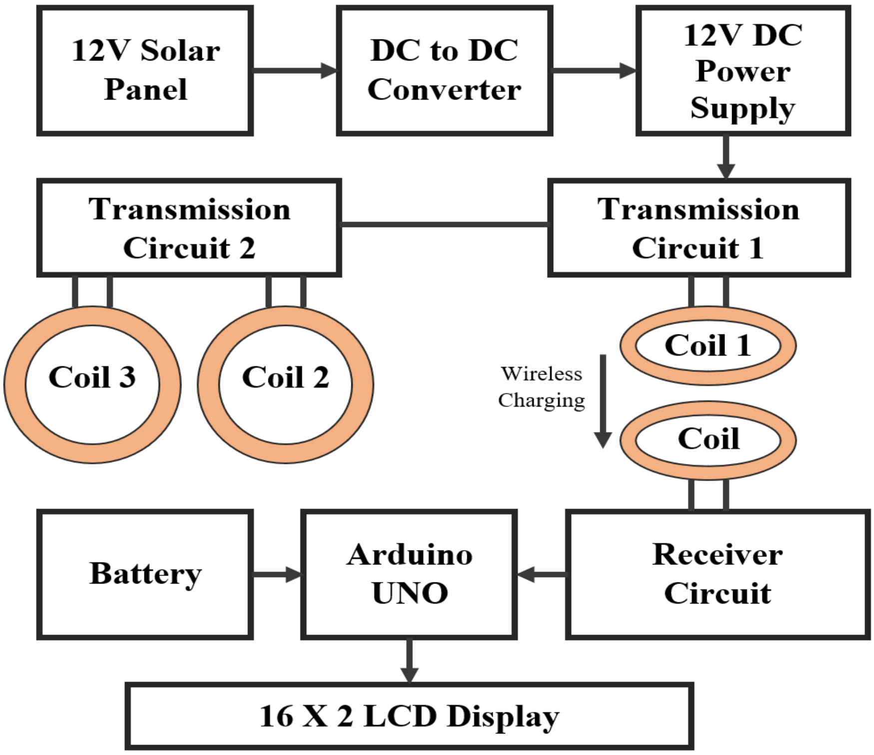
3. Implement an IR sensor-based mechanism to detect the presence of an electric vehicle for seamless initiation of the charging process.
4. Incorporate a relay module for wirelessly transmitting power to the vehicle through a copper coil, ensuring safe and efficient charging.
5. Provide real-time feedback to users through an LCD display, indicating charging status and relevant information, enhancing user experience and system transparency.

III.LITERATURE REVIEW

The literature survey delves into the burgeoning field of solar-based electric vehicle (EV) wireless charging systems, exploring recent advancements, challenges, and future directions. Numerous studies have investigated the integration of solar energy with wireless charging technologies to enhance the sustainability and accessibility of EV charging infrastructure. Researchers such as Bugatha Ram Vara Prasad et al. (2021) and AbhijithNidmar et al. (2019) have proposed innovative solutions that leverage solar panels for power generation and inductive coupling methods for wireless power transfer. These approaches not only reduce reliance on fossil fuels but also offer convenience and flexibility for EV users by enabling on-the-go charging without physical connections. Furthermore, studies by T.D. Nguyen et al. (2020) and BhuvaneshArulraj et al. (2019) have explored the feasibility of wireless charging technologies, highlighting their potential to revolutionize the EV charging landscape. By synthesizing insights from these research endeavors, this literature survey aims to provide a comprehensive overview of the state-of-the-art in solar-based EV wireless charging systems, identifying key trends, challenges, and opportunities for further exploration.
The literature review underscores the importance of advanced energy management systems and intelligent algorithms in optimizing the utilization of renewable energy sources and regulating the charging process. Researchers such as M. Singh et al. (2019) and Carlos A. et al. (2016) have proposed real-time coordination systems and dynamic charging methods to enhance the efficiency and reliability of EV charging infrastructure. These innovations not only support the transition towards a more sustainable transportation ecosystem but also address concerns regarding grid integration, charging times, and infrastructure scalability. By evaluating and synthesizing findings from diverse research efforts, this literature survey aims to contribute to the ongoing discourse on solar-based EV wireless charging systems, providing insights into emerging technologies, research gaps, and potential avenues for future exploration and innovation.

IV.BASIC BLOCK DIAGRAM



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1. A 12V Solar panel captures solar radiation and converts it into electrical energy. The generated electricity is then fed into the system for charging purposes.

2. The DC to DC converter regulates and converts the solar-generated electrical energy into a suitable voltage compatible with the EV's charging system, ensuring seamless integration.

3. Transmission Circuits 1 & 2 directly converted electrical energy to corresponding coils for wireless power transmission to the receiver circuit.

4. Receiver Circuit captures and regulates wirelessly transmitted power, interfacing with the Arduino UNO for optimal charging performance.

5. Arduino UNO serves as the central control unit, managing the charging process, monitoring system parameters, and coordinating various components for efficient operation.

6.
The 9V battery provides supplementary power to ensure uninterrupted operation and system reliability, acting as a backup power source when needed.

7. 16 X 2 LCD Display interfaces with the Arduino UNO, providing real-time monitoring and visualization of the charging process and system status for user convenience.

8. Oscillation Generation The BD139 NPN transistor generates oscillations, orchestrating high-frequency signals essential for wireless power transmission.

9. Resonant Circuit R1, C1, and C2 fine-tune the frequency of oscillation, ensuring coherence and stability in the oscillatory output essential for wireless power transmission.

10. LED Indicator LED 1 serves as a visual indicator, illuminating to signify the circuit's operational status, providing feedback to the user.

11. Power Supply converts alternating current induced in the coil into rectified direct current, providing a clean and stable DC supply for the system.

12. Voltage Regulation the IC 7805 voltage regulator ensures stability by regulating the DC supply voltage, maintaining a steady output for reliable system performance.

13. Center-Tapped Coil is meticulously crafted to optimize magnetic field induction efficiency, essential for wireless power transmission.

14. BD139 NPN Transistor The BD139 transistor facilitates the generation of high-frequency signals, serving as a switching device in the circuit.

V.COMPONENTS

Solar Panel
A solar panel is composed of photovoltaic cells, typically made of semiconductor materials like silicon, that convert sunlight into electricity through the photovoltaic effect. These cells generate direct current (DC) electricity when exposed to sunlight, with the movement of excited electrons producing an electric current. Solar panels are structured as flat, rectangular panels containing an array of photovoltaic cells arranged in rows and columns. They find wide applications in generating electricity for residential, commercial, and industrial buildings, as well as in charging batteries for various solar-powered systems and providing power for remote locations or during emergencies.
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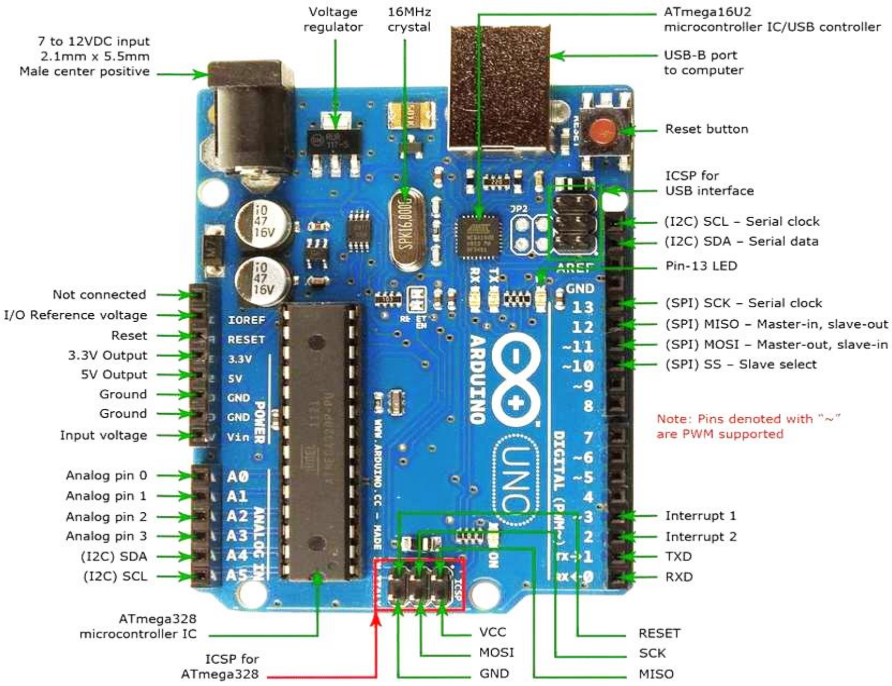
Arduino UNO R3

The Arduino UNO R3 is a versatile microcontroller board based on the ATmega328P, offering 14 digital input/output pins (6 PWM), 6 analog inputs, and a 16 MHz ceramic resonator. With its USB connection and power options, it provides a user-friendly interface for programming and experimenting, making it ideal for beginners and advanced users alike in electronics and prototyping projects.



DC to DC Converter

A DC to DC booster, also known as a 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, which is useful for applications requiring higher voltage levels than what is initially available. This conversion is achieved through the use of switching components such as transistors and inductors, which efficiently regulate the voltage to the desired level.

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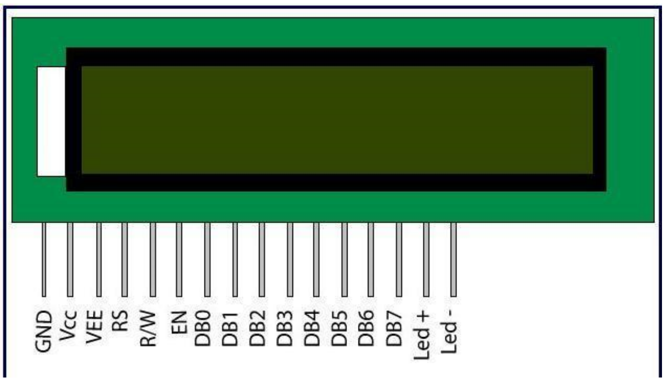
SPDT Switch

An SPDT switch, or Single Pole Double Throw switch, controls two different circuits with a single input, either manually or electromagnetically, allowing for versatile circuit control and configuration.

16 x 2 LCD display

A Liquid Crystal Display (LCD) utilizes liquid crystal technology to produce visible images, offering thin, lightweight displays commonly found in devices such as laptops, televisions, smartphones, and handheld gaming consoles.



9V Battery

The nine-volt battery, or 9-volt battery, is an electric battery that supplies a nominal voltage of 9 volts. Actual voltage measures 7.2 to 9.6 volts, depending on battery chemistry. Batteries of various sizes and capacities are manufactured; a very common size is known as PP3, introduced for early transistor radios.

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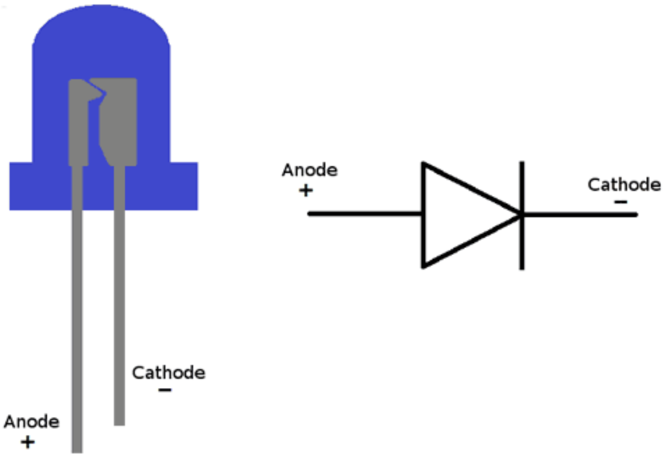
LED 5mm

A 5mm Light Emitting Diode (LED) is a semiconductor device that emits light when an electric current passes through it, commonly used for various lighting applications due to its compact size and energy efficiency.



18650 Li Ion Battery

The Li-Ion Battery 18650, with its cylindrical design and high energy density, provides a sustainable and versatile power solution for various electronic devices, ranging from flashlights to electric vehicles, offering efficient energy storage and release.

Transmission Circuits

Transmission Circuit 1 & 2 incorporate essential components such as resistors, capacitors, transistors, LEDs, and coils, enabling efficient signal amplification and wireless power transmission within the circuit.

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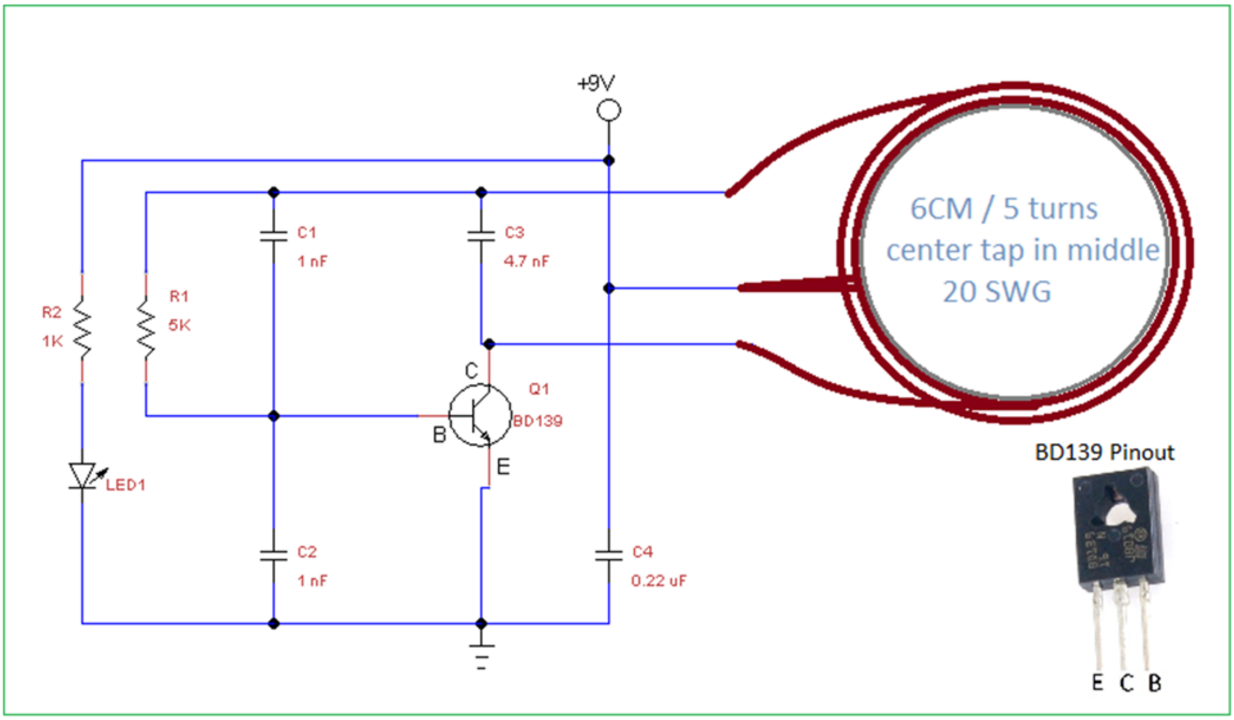
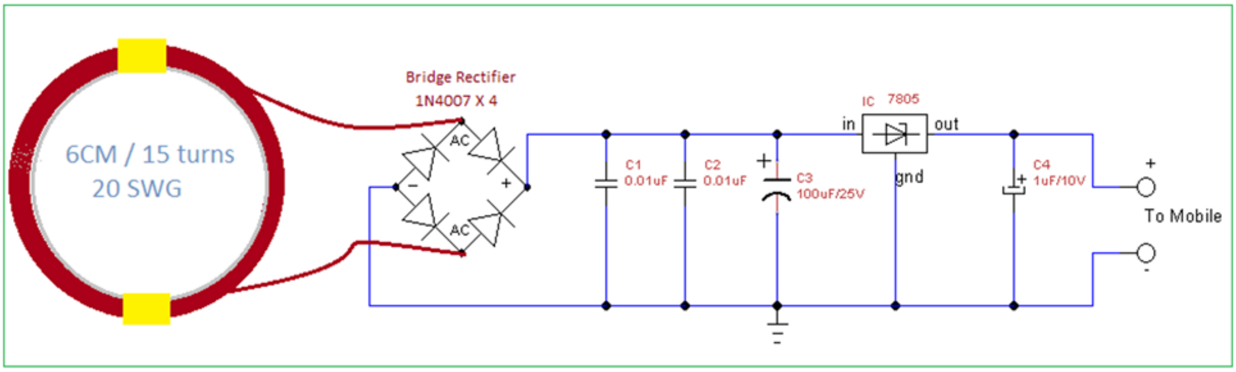


Receiver Circuit

The coil, bridge rectifier, capacitors, and IC 7805 are key components of the receiver circuit, working together to efficiently capture, rectify, and stabilize the wirelessly transmitted energy, ultimately providing a reliable and regulated power supply for connected electronic devices.



Transmission & Receiver Circuit

The DC power source initiates the wireless power transfer process, while the oscillator circuit, transmitting and receiving coils, rectification circuit, and voltage/current regulation components ensure efficient and regulated power transmission to the target device, enabling its operation without the need for physical connections.

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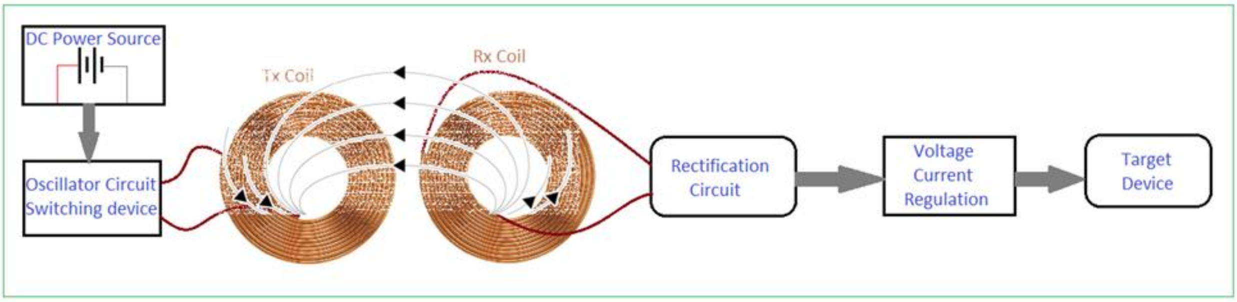

VI.ADVANTAGE

Advantage :

1. Efficiency and Convenience streamlines the charging process without physical cables, enhancing user experience.
2. Renewable Energy Utilization reduces carbon footprint by harnessing solar power for charging.
3. Smart Charging Capabilities is intelligent management that optimizes charging times based on solar availability and battery status.
4. Real-time Monitoring LCD display provides instant feedback on charging status, enhancing control.
5. Scalability and adaptable design suits various electric vehicle power requirements, ensuring compatibility.

VII. APPLICATION

1. Remote Charging Enables convenient charging at any location within transmission range.
2. Smart Grid Integration Optimizes energy usage by feeding excess solar power back to the grid.
3. Real-time Monitoring Arduino controller facilitates monitoring and adjustment of charging parameters.
4. User Interface LCD display provides instant feedback on charging status and battery level.
5. Scalability Adaptable design suits various electric vehicle power requirements.
6. Sustainable Energy Use Promotes eco-friendly charging practices, reducing reliance on non-renewable sources.
7. Enhanced Convenience Simplifies charging process, offering flexibility and ease of use.

VIII. RESULT

The solar wireless charging system for electric vehicles showcases impressive efficiency, boasting charging rates between 88% and 93%. This rivals traditional plug-in methods while offering the added convenience of wireless charging. Its ability to charge EVs while in motion eliminates frequent stops at charging stations, significantly extending their range and usability. By integrating solar power, the system further enhances sustainability, reducing reliance on conventional energy sources and offering cost savings through the utilization of cheaper electricity. Overall, this system marks a significant leap forward in electric vehicle infrastructure, promising a greener, more efficient, and sustainable future for transportation.

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IX. CONCLUSION

In conclusion, the Solar Wireless Electric Vehicle Charging System presents a transformative solution at the intersection of sustainability and technology. By harnessing solar energy and wireless transmission, it offers an efficient and convenient charging method for electric vehicles. With its Arduino-based control and monitoring capabilities, coupled with energy storage using 18650 batteries, this system not only reduces reliance on fossil fuels but also enhances user experience and accessibility. As we strive towards a greener future, innovations like these pave the way for more sustainable transportation solutions.

X. FUTURE SCOPE

- **Integration with Smart Cities** - Embedding solar wireless charging into city infrastructure for seamless EV charging.
- **Improved Efficiency** - Advancements in solar panel and wireless charging tech enhance system effectiveness.
- **Dynamic Charging** - Potential development of road-embedded wireless charging pads for on-the-go charging.
- **AI Integration** - Utilizing AI to optimize charging processes for maximum efficiency and battery longevity.
- **Sustainability Drive** - Solar-powered wireless charging contributes to reducing transportation's carbon footprint.
- **Enhanced Mobility** - Offers convenient, hassle-free charging options, promoting widespread EV adoption.
- **Future-Ready Solutions** - Anticipates evolving energy needs, aligning with global sustainability goals.

XI . ACTUAL MODEL

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