WIRELESS CHARGING SYSTEM FOR ELECTRIC VEHICLES INTEGRATED WITH ROAD INFRASTRUCTURE

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Introduction/Background:

Electric vehicles (EVs) are rapidly gaining traction for their environmental benefits and reduced cost of operation. However, challenges like long charging times and lack of infrastructure in remote areas still persist. This project proposes an innovative **Wireless EV Charging System** designed to address these limitations by enabling EVs to charge while moving using solar-powered, embedded road coils.

The system eliminates the need for frequent charging stops and external power supply dependency. Instead, it utilizes solar panels, embedded copper coils, energy converters, and a control unit. A blinking LED indicator on the vehicle serves as a visual signal for successful energy reception and ongoing charging. The project aims to promote clean energy and support future EV infrastructure development in smart cities and rural settings alike.

Objectives:

- To develop a solar-powered wireless charging system for in-motion EVs.
- To implement inductive charging using embedded coils in road infrastructure.
- To eliminate the dependency on conventional grid-powered EV charging stations.
- To indicate charging activity through a blinking LED on the vehicle.
- To create a working prototype to demonstrate real-time wireless power transfer.

Methodology:

The project consists of a solar panel that charges a battery through a charge controller. The DC energy stored in the battery is converted to AC via a transformer and regulated using electronic circuitry. This AC energy powers a set of copper transmitter coils embedded into a simulated road surface.

As an EV prototype moves over this road section, its receiver coil picks up the energy wirelessly. The current is induced via electromagnetic coupling and then converted back to DC to charge the vehicle's battery. A blinking LED on the vehicle provides visual feedback, indicating that energy is being successfully received and the EV is charging.

Main Components:

- Arduino Uno Microcontroller
- Solar Panel
- Battery
- Transformer
- Regulator Circuit
- Transmitter and Receiver Coils
- AC to DC Converter
- LED Indicator
- Resistors, Capacitors

- PCB board, Switches, Vehicle Body

Results & Conclusions:

The prototype successfully demonstrates wireless, solar-powered EV charging while in motion. The blinking LED confirms that energy is being received and charging is active. The system proves that EVs can be charged dynamically without needing to stop. It eliminates dependency on grid power and offers a cleaner, more flexible infrastructure solution, especially for remote or underdeveloped areas.

Project Outcome & Industry Relevance:

This project showcases a practical and scalable solution for future smart transportation systems. Its ability to enable dynamic EV charging using renewable energy is highly relevant for urban planners, automotive industries, and energy sectors. By minimizing downtime and using green power, it promotes the long-term sustainability of EV ecosystems.

Working Model vs. Simulation/Study:

This project is a **working model** demonstrating real-time wireless EV charging using embedded systems and solar energy.

Project Outcomes and Learnings:

- Learned how to integrate renewable energy with power electronics.
- Gained hands-on experience in wireless energy transmission.
- Developed a physical prototype to demonstrate inductive charging.
- Improved skills in embedded programming and circuit design.
- Understood real-world applications of sustainable energy solutions.

Future Scope:

The future enhancements of this project include:

- Scaling up for real road integration and high-speed charging.
- Integrating sensors to detect vehicles and activate coils only when needed.
- Implementing smart traffic data systems to manage power distribution dynamically.
- Enhancing power transmission efficiency and safety in public roads.
- Partnering with government bodies to pilot the system in smart city infrastructure.
- Expanding the concept for logistics fleets, public buses, and shared mobility services.
- Enabling IoT connectivity for system monitoring and diagnostics.
- Cost optimization for large-scale deployment.