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Solar-Powered Wireless Dynamic Charging System for Electric Vehicles

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ABSTRACT: In order to facilitate the dynamic charging of electric vehicles while they are in motion, this research presents a solar-powered wireless charging system. The system replaces traditional charging stations with a solar panel, battery, transformer, regulator circuitry, copper coils, AC to DC converter, ATmega microprocessor, and LCD. The system is powered by a battery that is charged by the solar panel. To ensure effective charging without stopping, wireless energy is transferred to a coil underneath the car via copper coils buried in the road. Notably, the L298N module's incorporation improves charging process control through the use of H-Bridge technology and Pulse Width Modulation (PWM). This system enhances EV mobility and lessens dependency on conventional power sources by combining solar energy and wireless charging, making it a sustainable and affordable solution that helps create a greener urban transportation infrastructure.

I. INTRODUCTION

Electric vehicles (EVs) are quickly replacing conventional cars that run on fossil fuels in the automotive sector because they are cleaner. Reducing reliance on non-renewable energy sources and greenhouse gas emissions requires this change. However, the lack of charging infrastructure, which is frequently expensive and takes up a lot of physical space, severely restricts the mainstream adoption of EVs. A solar-powered wireless charging system for electric vehicles that allows charging while the vehicle is moving is presented in this study as a solution to these problems. Our approach maximizes the use of renewable energy while improving EV user convenience by enabling dynamic charging through embedded copper coils in highways, in contrast to existing charging techniques that require stationary connections to charging stations.

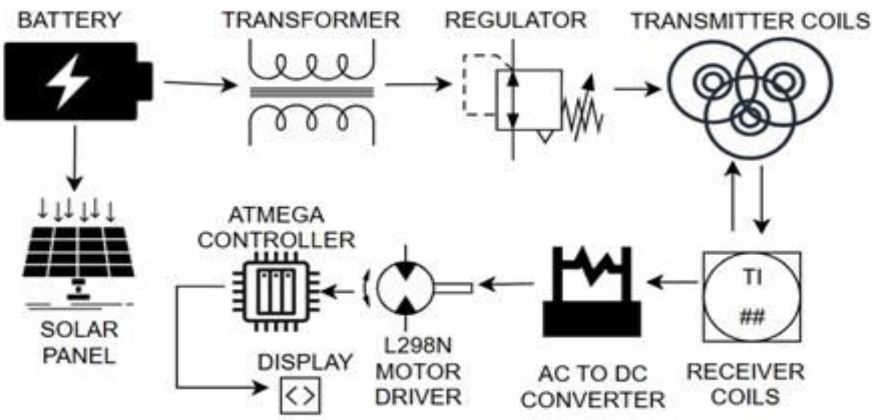

FIG: 1 BLOCK DIAGRAM

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A solar panel, battery, transformer, regulator circuitry, AC to DC converter, ATmega microcontroller, and LCD display are all part of the suggested system. The battery is charged by solar energy, which drives the inductive charging mechanism. The integration of an L298N motor driver module, which offers fine control over DC motors and stepper motors to improve charging efficiency, is a distinctive feature. This method overcomes the significant drawbacks of current EV charging infrastructures, including fixed sites and downtime, by fusing solar energy with wireless charging technology. This invention is positioned as a major breakthrough in electric mobility solutions since it not only helps create a more sustainable energy ecosystem but also opens the door for an easy-to-use method of charging electric vehicles.

II. PROPOSED SYSTEM

Solar-Powered Wireless Dynamic Charging for Electric Vehicles
EVs may be charged while moving thanks to a dynamic wireless charging infrastructure driven by solar energy. Improves EV sustainability and lessens the demand for fixed charging.

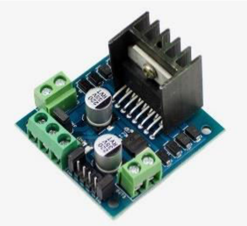
Exceptionally Effective Solar Panels
Increase energy generation, particularly along roadsides, by using high-efficiency monocrystalline or bifacial solar panels, which absorb sunlight from both sides.

Advanced Batteries for Energy Storage
Increase storage capacity and guarantee a steady power supply by combining high-capacity lithium-ion or lithium iron phosphate batteries with supercapacitors to manage peak loads and deliver steady power output.

Optimizing DC-AC-DC Conversion
Use cutting-edge AC to DC conversion circuitry and a high-efficiency inverter for DC to AC conversion to reduce energy loss and maximize the amount of energy available for charging.

Superior Copper Coils with Inductive Coupling Resonance
Optimize energy transfer by combining multi-turn, flat spiral copper coils with resonant inductive coupling to boost wireless power transmission's efficiency and range.

Improved Motor Control with the L298N Module
Utilize the L298N motor driver to regulate power flow. PWM and H-Bridge technologies are used to control rotation and speed for adaptive power flow and increased efficiency.



Advanced Microcontroller (ARM Cortex or ATmega, for example)
Combine wireless connection for remote monitoring with an ATmega or ARM Cortex microcontroller for real-time monitoring of solar power input, battery condition, and charging efficiency.

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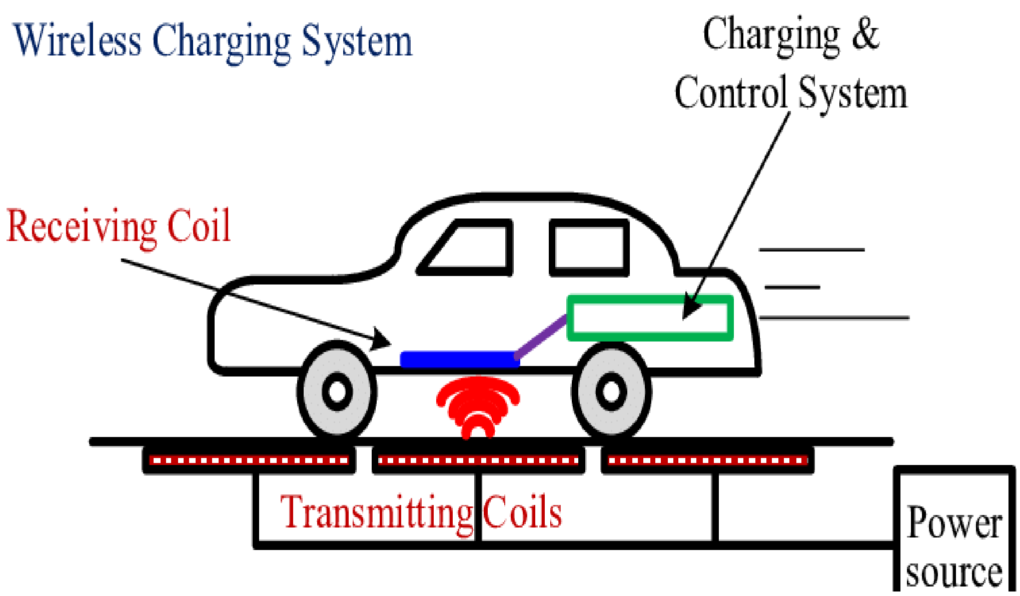

FIG: 2 CONCEPT DIAGRAM

III. OPERATION AND SYSTEM FUNCTIONALITY

Energy Production and Storage: DC power produced by solar panels is stabilized by supercapacitors and stored in batteries. For transmission, the DC power is transformed into AC.

Transferring Energy Wirelessly using Resonant Inductive Coupling: Resonant inductive coupling is used to optimize power transfer using high-efficiency copper coils embedded in the road. The EV's receiving coil continuously transforms AC power back into DC for battery charging.

Adaptive control with real-time monitoring: In addition to providing real-time data for system performance and charge status, the microcontroller dynamically regulates energy flow and modifies power levels in response to battery demands.

IV. LITERATURE SURVEY

The automobile industry is transitioning from fuel-powered vehicles to electric vehicles (EVs) due to the demand for environmentally friendly transportation. This study suggests a solar-powered wireless charging system that uses inductive coupling to enable EV charging while moving, doing away with the need for stationary charging stations and lowering reliance on the electrical grid. This method reduces infrastructure costs, improves user convenience, and lessens its impact on the environment by transferring renewable energy from copper coils embedded in roads. In the end, it provides an environmentally friendly, scalable solution that has the potential to transform EV charging infrastructure and encourage the wider use of EVs.

V. RENEWABLE ENERGY

In order to enable continuous, on-the-go charging, this study proposes a solar-powered wireless charging system for electric vehicles that uses inductive coupling through copper coils buried in the road. Efficient energy transmission from solar power to the EV battery without pausing at charging stations is made possible by the system's integration of parts such a solar panel, transformer, AC/DC converter, and Atmega controller.[1]

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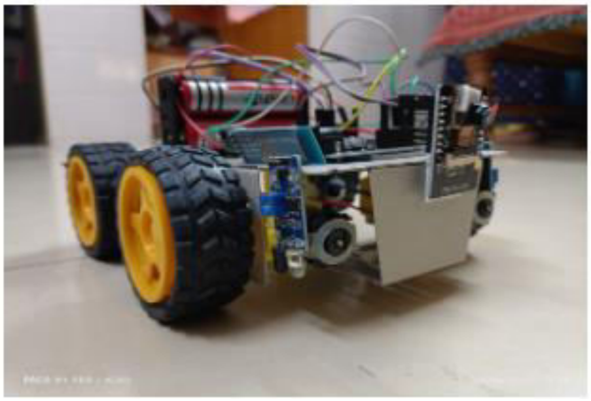
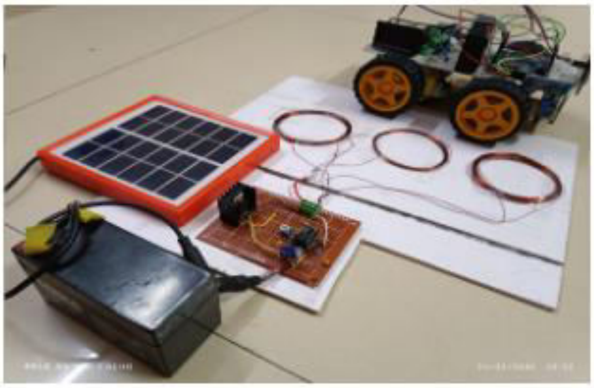
This paper introduces a dynamic solar-powered wireless charging system for electric vehicles, utilizing inductive coupling through embedded copper coils in road infrastructure. By integrating components such as a battery, transformer, ATmega controller, LCD display, regulator circuitry, solar panel, and AC to DC converters, the system facilitates continuous EV charging in motion, eliminating the need for stationary charging points or external wired connections and enhancing energy efficiency in sustainable transport.[2]

A Raspberry Pi Pico microcontroller is used by the Solar Wireless Electric car Charging System (SWEVCS) to effectively capture solar energy for electric car charging. In addition to a rechargeable battery and a boost converter guarantee efficient energy storage and delivery, the system uses inductive coils for wireless power transfer. Real-time feedback on the charging state is provided by a LCD display, allowing users to easily monitor the procedure. This creative method encourages sustainability and environmental friendliness by enabling EV owners to charge their cars separately from the grid.[3]





VI. ELECTRICAL ENERGY

In order to overcome the drawbacks of traditional wired systems, the central idea of emphasizes the promise of wireless charging via inductive coupling as a game-changing technology for electric vehicles (EVs). By utilizing inductive coupling, this method reduces the complexity of the infrastructure and tackles important EV issues like charging effectiveness, range, and usability, opening the door for improvements in EV technology as well as more general wireless power applications in daily life[4]

This project introduces a wireless, solar-powered electric car charging system that enables continuous charging while the car is moving. In order to charge a battery, solar panels transform DC electricity into AC for inductive transmission. Through electromagnetic induction, wireless energy transfer is made possible by primary and secondary copper coils incorporated into the road and vehicle. Without the need for external power sources or stationary charging stations, the system manages and monitors real-time charging using an ATmega processor, LCD display, control circuitry, and AC to DC converters.[5]

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FIG: 3 FINAL HARDWARE

VII. DRAWBACKS OF THE PROPOSED SYSTEM

Compared to conventional charging techniques, the Solar-Powered Wireless Dynamic Charging System for Electric Vehicles is less efficient and has higher initial setup expenses, among other drawbacks. Its functionality depends on the weather, and the embedded infrastructure needs to be maintained on a regular basis. Different EV models may have compatibility problems, and the system may interact with other devices. Furthermore, there could not be enough room for installation in cities, and customers might require some time to get used to this new charging technique.

VIII. APPLICATIONS OF THE SYSTEM

There are numerous important uses for the Solar-Powered Wireless Dynamic Charging System for Electric Vehicles. It can be incorporated into public transportation in cities so that electric buses can charge while they are moving. By allowing delivery trucks to be continuously charged, this system boosts productivity for commercial fleets. Additionally, it works well in parking lots and provides EV owners with easy wireless charging. Additionally, it can be used in private homes for homeowners looking for solar-powered charging options and can enable long-distance highway driving without the need for designated charging stations. These applications increase the effectiveness of using electric vehicles and support environmentally friendly transportation.

IX. CONCLUSION

In conclusion, the Solar-Powered Wireless Dynamic Charging System for Electric Vehicles is a major development in environmentally friendly transportation technology. This ground-breaking technology solves major issues like range anxiety and the requirement for a substantial charging infrastructure by allowing electric cars to be charged wirelessly while they are moving. Solar energy integration is a feasible alternative for a greener future since it not only lessens reliance on conventional power sources but also minimizes environmental damage. This system has the potential to completely transform the way electric vehicles are charged, with possible uses in parking lots, commercial fleets, public transportation, and residential settings. Adopting such innovative solutions will be essential in encouraging cleaner, more efficient modes of transportation and creating a more sustainable economy as the demand for electric vehicles continues to rise.

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