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A REVIEW PAPER ON SELF EV CHARGING TRACK AT 'BRT' ROAD

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INTRODUCTION

The growing concern over climate change and the depletion of fossil fuel resources has driven the world towards sustainable transportation solutions, and electric vehicles (EVs) have emerged as a promising alternative to gasoline-powered vehicles. EVs offer several benefits such as lower carbon emissions, reduced noise pollution, and lower operating costs. However, one of the major challenges faced by EV owners is the need for frequent charging, which limits their range and convenience. To overcome this limitation, self-charging electric cars have been developed as a potential solution, which can generate electricity on-the-go and reduce the dependency on external charging infrastructure. Self-charging technologies such as solar panels, regenerative braking, and thermoelectric generators can be integrated into EVs to generate electricity from renewable sources and provide a continuous supply of energy.

This research paper aims to explore the concept of self charging electric cars, their working principles, and potential benefits for sustainable transportation. The paper will analyze the feasibility and limitations of self charging technologies and provide an overview of successful self-charging EV models. The paper will also examine the potential environmental and economic impacts of self-charging EVs and their contribution towards achieving sustainable transportation. The findings of this research paper will provide insights into the potential of self- charging electric cars to revolutionize the EV market and contribute towards sustainable transportation

LITERATURE REVIEW

1) To address the dual problems of fuel reliance and air pollution, this study describes the design of a wireless ground to vehicle charging system powered by solar energy and specifically designed for electric vehicle (EV) charging stations. As the number of electric vehicles on the road steadily rises, they present a viable way to cut travel expenses by switching from conventional fuel to electricity, which is a more economical and sustainable option. With the introduction of a wireless EV charging system, this creative solution does away with the need for external power sources and permits continuous charging without interfering with driving. Utilizing solar power, the charging system incorporates solar panels, batteries, circuit regulators, boost converters, receiver and transmitter copper coils, AC/DC converters, microcontrollers (such as AT mega), LCD screens, and circuit regulators. This study describes a technique that shows that charging electric cars while driving is feasible and eliminates the need to stop. This technology for wireless solar electric vehicle charging presents a forward-thinking approach to sustainable mobility by providing a workable solution that can be easily included in the road infrastructure. For the wireless charging, in addition, various coil designs are suggested.

2) This study compiles, reviews, and discusses the relevant history, present status, and growing trends in wireless electric vehicle charging. Various reported concepts, technologies, and available literature are discussed in this paper. The literature can be divided into two main groups: those that discuss the technical aspects and those that discuss the operations and systems involved in wireless electric vehicle charging systems. There may be an overlap of discussion in some studies. However, there is no single study that combines all the relevant topics into a guide for researchers, policymakers, and government entities. With the growing inter estrin wireless charging in the electric vehicle industry, this study aims to promote efforts to realize wireless power transfer in electric vehicles

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3) Wireless Electric Vehicle Charging (WEVC) while drive is a ground breaking technologies aiming to enhance the practicality and efficiencies off electric vehicles (EVs). This method eliminates the need for traditional plugs-in charging, allowing EVs to charge seamlessly while in motions. Through inductive power transfers, the vehicles receives electricity from embedded charging infrastructures on the roads. The system relies on electro-magnetic fields, enabling a continuous powers transfer to the EV's battery. WEVC not only addresses range anxiety by also contributes to a sustainable and conveniently EV ecosystem. Challenge such as efficiency optimizations, standardizations, and infrastructures deployments remain, emphasis the ongoing evolutions off this transformative technology.

Technical Scope

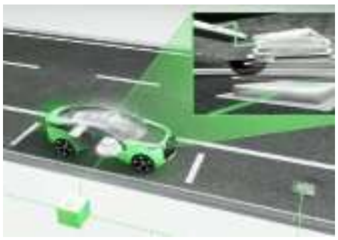
- **System Design & Integration**
  - Designing the wireless charging system using transmitter and receiver coils
  - Integrating solar panels, batteries, and converters for energy management
  - Developing control systems using microcontrollers (e.g., ATmega)
- **Power Electronics**
  - Implementing boost converters, AC/DC converters, and circuit regulators
  - Ensuring efficient energy transfer and voltage regulation
- **Wireless Power Transfer (WPT)**
  - Exploring different coil configurations for optimal inductive coupling
  - Testing charging efficiency under various driving conditions

Renewable Energy Utilization

- **Solar Energy Harvesting**
  - Capturing solar power through photovoltaic panels
  - Storing energy in batteries for continuous availability
- **Sustainable Infrastructure**
  - Reducing dependency on fossil fuels
  - Promoting clean energy adoption in transportation

Mobility & Infrastructure

- **On-Road Charging Capability**
  - Enabling dynamic charging while the vehicle is in motion
  - Minimizing the need for stationary charging stops
- **Integration with Road Networks**
  - Embedding transmitter coils into road surfaces
  - Designing scalable systems for highways and urban roads



Research & Development

- **Feasibility Studies**
  - Evaluating real-world applicability and cost-effectiveness
  - Analyzing environmental impact and energy savings
- **Prototype Development**
  - Building and testing small-scale models
  - Iterating designs based on performance metrics

Future Expansion

- **Smart Grid Compatibility**
  - Connecting with intelligent energy distribution systems
  - Enabling data-driven energy optimization
- **Policy & Regulation Support**
  - Aligning with government initiatives for green mobility
  - Supporting EV adoption through infrastructure innovation

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MATERIALS

A. Power Generation & Storage

- **Solar Panel (10W–50W)** For capturing solar energy. Choose based on your power needs.
- **Charge Controller** Regulates voltage from the solar panel to the battery.
- **Rechargeable Battery (12V Lead Acid or Li-ion)** Stores energy for continuous operation.

B. Power Conversion & Regulation

- **Boost Converter** Steps up voltage from battery to required transmission level.
- **Voltage Regulator (e.g., LM317 or LM7805)** Maintains stable output voltage for sensitive components.
- **AC to DC Converter Circuit** Converts received AC back to DC for battery charging.

C. Control & Monitoring

- **Microcontroller (e.g., ATmega328 or Arduino UNO)** Controls system logic and monitors voltage/current.
- **LCD Display (16x2 or OLED)** Shows real-time charging status and system metrics.
- **Sensors (Voltage/Current)** For feedback and safety monitoring.

D. Additional Components

- **Breadboard or PCB** For prototyping and circuit assembly.
- **Wires, Connectors, Soldering Kit** For building and testing the circuit.
- **Enclosure/Frame** To house and protect the components.

E. Optional Enhancements

- **Wireless Communication Module (e.g., Bluetooth or Wi-Fi)** For remote monitoring or data logging.
- **Cooling Fan or Heat Sink** If components heat up during operation

METHODOLOGY

1. **System Design & Planning**
   - **Define Objectives**
     - Provide sustainable EV charging using solar energy
     - Reduce grid dependency and carbon footprint
     - Ensure safe and efficient wired energy transfer
   - **Site Selection (for real-world models)**
     - Choose a location with optimal solar exposure
     - Ensure accessibility for EVs and safety for users
2. **Solar Power Generation**
   - **Solar Panel Selection**
     - Choose panels based on required wattage (e.g., 250W–1kW for lab models)
     - Consider panel efficiency and local irradiance
   - **Mounting & Orientation**
     - Install panels at optimal tilt angle for maximum sunlight absorption
     - Use fixed or tracking mounts depending on budget
3. **Energy Storage & Management**
   - **Battery Integration**
     - Use rechargeable batteries (Li-ion or Lead Acid) to store solar energy
     - Size the battery based on expected load and autonomy
   - **Charge Controller**
     - Regulates voltage from solar panels to prevent overcharging
     - MPPT (Maximum Power Point Tracking) controllers are preferred for efficiency
4. **Power Conversion**
   - **DC to AC Conversion (if needed)**
     - Use inverters to convert stored DC to AC for EVs requiring AC input
     - Ensure inverter capacity matches system output
   - **Voltage Regulation**
     - Use voltage regulators to maintain stable output
     - Protect EV battery from voltage fluctuations

5. **Wired Charging Interface**
   - **Charging Cable & Connector**
     - Use standard EV connectors (Type 1, Type 2, CCS, etc.)
     - Ensure compatibility with target EV model
   - **Safety Mechanisms**
     - Include circuit breakers, fuses, and insulation
     - Implement emergency shutoff and grounding
6. **Control & Monitoring**
   - **Microcontroller Integration (e.g., Arduino, ATmega)**
     - Monitor voltage, current, and battery status
     - Display data on LCD or send to cloud for logging
   - **User Interface**
     - Simple dashboard showing charging status, solar input, battery level
7. **Testing & Validation**
   - **Performance Testing**
     - Measure charging time, efficiency, and energy losses
     - Test under different sunlight and load conditions
   - **Safety & Reliability Checks**
     - Ensure thermal stability, electrical insulation, and fault tolerance
8. **Analysis & Optimization**
   - **Data Collection**
     - Log energy input/output, charging cycles, and solar performance
   - **Efficiency Improvements**
     - Optimize panel orientation, upgrade controllers, reduce conversion losses

REFRENCES

1. *SINTEF Research, Norway (2018):*
   "Technology for Dynamic On-Road Power Transfer to Electric Vehicles."
   → Explains both conductive (wired) and inductive road charging systems.
2. *Gustavsson, J. et al. (2017):*
   "Automatic Conductive Charging of Electric Cars."
   → Focuses on metal rail tracks and automatic pickup arms for charging.
3. *Konstantinou, K. et al. (Purdue University, 2019):*
   "Feasibility Study and Design of In-Road Electric Vehicle Charging."
   → Details design and testing of embedded conductive rails in roadways.
4. *Ultraslim S-Type Power Supply Rails Paper (ResearchGate, 2015):*
   → Proposes thin conductive rails (4 cm) for in-road power transfer.
5. *Alstom APS Tram System (France):*
   → Real-world conductive rail technology used in trams, adaptable for EVs.
6. *Elways AB (Sweden):*
   → Developed and tested electric road systems using conductive tracks for trucks.
7. *Electreon Wireless (Israel/Italy):*
   → Combines conductive and inductive technology for dynamic charging highways.
8. *Chen, Z. et al. (2017):*
   "Optimal Deployment of Charging Lanes for Electric Vehicles."
   → Studies location optimization for conductive and inductive lanes in cities.
9. *KAIST OLEV Project (Korea):*
   → Demonstrated dynamic charging buses; partly wireless but foundational for hybrid systems.
10. *Mazhoud, B. et al. (2022):*
    "Pavement Integration of an Inductive Charging System for EVs."
    → Gives design ideas for embedding power systems safely in pavement.