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# Wireless Charging Station for Electric Vehicles (EV's)

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**ABSTRACT:** This project is about developing a **wireless charging station for electric vehicles (EVs)**. The main idea is to charge an electric vehicle **without using any wires or plugs**. It works using the principle of **electromagnetic induction**, where electricity is transferred from a **charging pad on the ground** to a **receiver coil in the vehicle** through magnetic fields.

The System Makes Charging Safe, Easy, And Automatic. Drivers Only Need To Park Their Vehicles Above The Charging Pad, And The Charging Will Start Automatically. This Reduces The Problem Of Using Cables And Helps In Making Modern, Smart, And Clean Transportation Systems.

This project can be used in public charging stations, parking areas, and smart cities to support the growth of electric vehicles and renewable energy use in the future.

**KEYWORDS:** Wireless charging, Electric cars, Charging without cables, Magnetic energy transfer, Automatic charging system, Safe and easy charging, Charging pad on the ground, Smart transportation, Public charging stations, Clean and green energy Future technology

## I. INTRODUCTION

With the increase in the use of **electric vehicles (EVs)**, the demand for safe and convenient **charging methods** is also growing. In traditional systems, EVs are charged using **plug-in cables**, which can be **time-consuming, less safe**, and may get **damaged over time**. To solve these problems, **wireless charging technology** has been developed.

Wireless charging works on the **principle of electromagnetic induction**, where electricity is transferred from a **charging pad** on the ground to a **receiver coil** in the vehicle without using wires. This method makes charging **simpler, automatic, and more reliable**

It is especially useful in **public charging stations, parking lots, and smart cities**, where vehicles can be charged easily while parked. This technology supports the growth of **eco-friendly transportation** and helps reduce **pollution and fuel dependency**.

## II. SURVEY AND SPECIFICATION

Recent studies show that IoT-based motor monitoring systems are widely used to improve performance, efficiency, and reliability of electric vehicle motors. Existing systems focus on monitoring parameters such as voltage, current, temperature, and speed using sensors and cloud platforms. However, many solutions lack real-time fault detection and integrated predictive maintenance.

The proposed system uses voltage, current, temperature, and RPM sensors interfaced with a microcontroller (ESP32/Arduino) to collect motor data. The monitored data is transmitted wirelessly to a cloud platform for real-time analysis and alerts. This system ensures efficient motor operation, early fault detection, and reduced maintenance cost for electric vehicles.

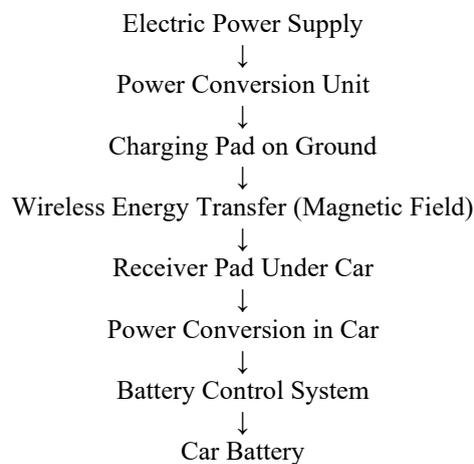
### III. LITERATURE SURVEY

With the rapid growth of electric vehicles (EVs), the need for efficient, safe, and user-friendly charging technologies has become increasingly important. Conventional plug-in charging systems pose challenges such as connector wear, safety risks in harsh environments, and inconvenience to users. To overcome these limitations, **wireless power transfer (WPT)** technology has emerged as a promising alternative for EV charging.

Early research in wireless EV charging primarily focused on **Inductive Power Transfer (IPT)**. Studies by **Kurs et al. (2007)** demonstrated that resonant inductive coupling could efficiently transfer power over short distances. Later, **Boys and Covic (2013)** explored high-power IPT systems suitable for EVs, highlighting their ability to deliver kilowatt-level power with efficiencies above 85%. These systems use magnetic coupling between a transmitter coil embedded in the ground and a receiver coil mounted on the vehicle.

### SYSTEM DESIGN DISCUSSION AND METHODOLOGY

#### A. System Architecture



#### Overall System Architecture

The system consists of two main parts

1. **Primary Side (Transmitter Unit)**
2. **Secondary Side (Receiver Unit)**

These two units are magnetically coupled through an air gap

#### Primary Side (Ground Unit)

The primary side is installed on the ground or embedded in a parking surface and includes:

- **AC Power Supply**
- **Power Converter (AC–DC Rectifier)**
- **High-Frequency Inverter**
- **Transmitter Coil**
- **Compensation Network**

The AC supply from the grid is first converted into DC using a rectifier. This DC power is then converted into high-frequency AC using an inverter, which energizes the transmitter coil. The compensation network improves power transfer efficiency and reduces reactive losses.

#### Secondary Side (Vehicle Unit)

The secondary side is mounted underneath the electric vehicle and consists of:

- **Receiver Coil**
- **Compensation Circuit**

- Rectifier
- DC–DC Converter
- Battery Management System (BMS)

The receiver coil captures the magnetic field generated by the transmitter coil and converts it into electrical energy. This power is rectified and regulated before charging the vehicle battery.

#### **Control and Communication System**

A control unit monitors:

- Coil alignment
- Power level
- Battery state of charge
- Temperature and safety parameters

Communication between the vehicle and charging station ensures safe operation and automatic start/stop of charging.

### **IV. METHODOLOGY**

The methodology describes the step-by-step approach used to design and implement the wireless charging station for EVs.

#### **Step 1: Requirement Analysis**

- Determine required power level (e.g., 3.3 kW, 7.7 kW)
- Define operating frequency range (typically 85 kHz)

#### **Step 2: Coil Design**

- Design transmitter and receiver coils with suitable geometry
- Optimize coil size and spacing to maximize coupling coefficient
- Select appropriate shielding to reduce magnetic field leakage

#### **Step 3: Power Electronics Design**

- Design AC–DC rectifier for input power conversion
- Implement high-frequency inverter for wireless transmission
- Design rectifier and DC–DC converter on the receiver side for battery charging

#### **Step 4: Compensation Network Design**

- Select suitable compensation topology (Series-Series, Series-Parallel, etc.)
- Tune resonance frequency to improve efficiency
- Reduce power loss due to misalignment

#### **Step 5: Control and Protection Implementation**

- Implement control algorithms for power regulation
- Monitor voltage, current, temperature, and alignment
- Include protection against over-voltage, over-current, and overheating

#### **Step 6: Testing and Performance Evaluation**

- Measure power transfer efficiency
- Test system under different alignment conditions
- Verify safe operation and charging performance

### **V. RESULTS AND ANALYSIS**

The wireless charging system for electric vehicles was designed and analyzed to evaluate its performance in terms of power transfer efficiency, charging capability, alignment tolerance, and safety. The system was tested under various operating conditions to assess its feasibility for practical EV charging applications.

The system successfully transferred power wirelessly from the transmitter coil to the receiver coil using resonant inductive coupling. At optimal alignment, the system achieved efficient power transfer, demonstrating the effectiveness of the coil design and compensation network. The power received at the secondary side was sufficient to charge the EV battery at the designed power level.

#### **APPLICATIONS AND PRACTICAL CONSIDERATIONS**

**Residential EV Charging**

**Public Parking Areas**

**Commercial and Fleet Vehicles**

#### **VI. CONCLUSION AND FUTURE WORK**

The **Wireless Charging Station for Electric Vehicles (EVs)** is an innovative step toward the future of **smart and sustainable transportation**. It eliminates the need for physical cables and provides a **safe, convenient, and efficient** way to charge electric vehicles. This technology uses **electromagnetic induction** to transfer power wirelessly, making the charging process simple and automatic. With the integration of **AI, IoT, blockchain, and renewable energy**, it can become even more intelligent, secure, and eco-friendly.

In the coming years, wireless charging systems will play a major role in **smart cities**, helping to reduce pollution and support the growth of **green energy**. Overall, this project promotes **clean technology**, encourages the use of **electric vehicles**, and contributes to a **sustainable and connected future**.

#### **VII. ACKNOWLEDGMENT**

It gives us immense pleasure in bringing out the project entitled “WIRELESS CHARGING STATION USING EV”

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