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Electric Vehicle Wireless Charging Station Using Arduino Uno

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Abstract: *A fast developing technology used in many different fields, wireless power transmission (WPT) allows power to be transferred from a source to an electrical load without the need for physical connections. WPT is especially useful in situations when traditional wiring is neither feasible or feasible. The mutual inductance principle underlies this technology. One potential use case is in the automotive industry, specifically in electric vehicles (EVs). The study and creation of wireless charging systems specifically designed for EVs that use Tesla coils for power transfer are the main topics of this research paper. Establishing effective charging systems with a DC power supply, transmission coil, reception coil, and battery acting as the electric load is the main goal.*

Keywords: Electric Vehicle, Wireless Charging, WPT, Wireless Power Transmission

I. INTRODUCTION

In order to reduce pollution emissions from conventional fossil fuel vehicles and provide a more affordable option for transportation, there is a global movement in the modern era toward electric mobility. However, issues with electric vehicles' range and infrastructure for charging prevent them from being widely used. Long stops at charging stations are no longer necessary thanks to the development of wireless charging technologies. These days, charging electric cars is simple, even when they are moving and parked in garages or other approved locations. The idea of wireless power transfer has gained popularity due to the success of wireless data, audio, and video transmission. With his ground-breaking inventions, such as wireless power transfer, renowned scientist Nikola Tesla made important contributions to this subject. In 1891, he started experimenting with wireless power transfer, which led to the creation of the Tesla coil. Tesla started the enormous project of building the Wardenclyffe Tower in 1901 in order to create a ground-breaking wireless energy transmission system. However, the tower met a tragic end on July 4th, 1917, when it was demolished for scrap due to financial restrictions and Tesla's debts.

II. MOTIVATION

Addressing the growing demand for electric vehicles as a more ecologically friendly substitute for conventional gasoline and diesel automobiles is the driving force behind this project. The have to regularly recharge batteries is a significant disadvantage of electric vehicles. With the present wire-based charging systems, this can be difficult and time-consuming. With the use of an inductive coupling wireless charging technology, electric vehicles can be charged more effectively and conveniently without the use of wires or direct human contact. The goal of this project is to create and prove the viability of an electric vehicle wireless charging system that might lessen dependency on fossil fuels and increase the accessibility and usability of electric vehicles.

III. PROBLEM STATEMENT

The existing electric vehicle charging system uses plugs and cables, which can be messy and inconvenient, especially when charging several cars at once. The project's objective is to create a wireless charging system for electric cars that does away with the need for plugs and cords, improving charging efficiency and convenience.

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IV. BASIC PRINCIPLE

The basic idea of wireless charging is comparable to how a transformer works. There are a transmitter and a receiver in this configuration. First, high-frequency alternating current is created from a typical 220V 50Hz AC power source. After then, the transmitter coil receives this high-frequency AC, which creates an alternating magnetic field. This field causes the receiver coil to produce an AC power output as it intersects with the coil. However, maintaining resonance frequencies between the transmitter and receiver is essential for effective wireless charging. Compensation networks are interconnected at both ends to accomplish this. The Battery Management System (BMS) then converts the AC electricity received at the receiver end into DC and channels it to the battery.

V. SYSTEM CONSTRUCTION

Using an Arduino, an ultrasonic sensor, a Tesla coil, batteries, an LCD display, and a relay module, a wireless EV charging station can be built. This includes configuring the ultrasonic sensor to detect the presence of an EV, turning on the Tesla coil through a relay module after authentication, and displaying the available charging slots on an LCD. Relay control, authentication logic, and sensor interface are all handled by Arduino code for wireless charging. Safety measures reduce risks like overheating, and testing guarantees sensor accuracy and Tesla coil efficiency.

4.1 Arduino Uno

The ATmega328P chip powers the Arduino Uno board. It has six analog inputs and fourteen digital input/output pins, six of which support PWM output. It is a complete package to support the microcontroller, featuring a reset button, ICSP header, power jack, USB connection, and a 16 MHz quartz crystal. Starting is easy: just use a USB connection to a computer or power it with a battery or AC-to-DC adaptor. Because the chip can be readily replaced for a low cost, even if mistakes are made, the Uno offers a forgiving platform for experimentation that allows for a fresh start. The name "Uno," which translates to "one" in Italian, was chosen to mark the launch of Arduino Software (IDE) version 1.0. Although Arduino's first standard was the Uno board and IDE 1.0, the platform has subsequently changed with successive iterations. With several other boards available for distinct uses, the Uno, the first USB Arduino board, acts as the reference model for the Arduino ecosystem.

4.2 Relay Module

In automatic control circuits, a 5V relay is commonly used as an automated switch to regulate high-current loads using a low-current signal. The input voltage range in which the relay functions is 0 to 5V. It has five pins.

4.3 Ultrasonic Sensor

A device that uses sound waves to measure an object's distance is called an ultrasonic sensor. A sound wave at a particular frequency is emitted, and the reflected wave is then detected. The sensor can calculate the distance between itself and the item by measuring the wave's journey to and from the object. These sensors usually send out ultrasonic waves that pass through the atmosphere at a frequency of 40,000 Hz. The wave reflects back to the sensor if there is an obstruction in its path. The distance can be computed by taking into account the round-trip time and the speed of sound. Ground, VCC, Trig, and Echo are the four pins on the HC-SR04 Ultrasonic Module. While the Trig and Echo pins can be linked to any Digital I/O pin on the Arduino Board, the Ground and VCC pins need to be attached to the appropriate Ground and 5 volt pins on the Arduino Board.

4.4 LCDDisplay

Liquid Crystal Displays (LCDs) are widely used in a variety of embedded projects because of their accessibility, affordability, and programmability. It is present in many commonplace electronic gadgets, including calculators and cell phones. An LCD's characters usually consist of forty pixels, or dots, and the display's overall pixel count can be computed as (32 x 40), or 1280 pixels. It's crucial to tell the LCD where these pixels are located when integrating with a microcontroller.

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VI. CIRCUIT DIAGRAM

The "Wireless Electric Vehicle Charging Station" project entails configuring an Arduino Uno to manage the charging system's functionality. To determine whether a car is there, three ultrasonic sensors are placed in front of the charging slot and connected to the Arduino. The relay will automatically turn on if a car is detected in the slot, enabling electricity to pass through the Tesla coil, which is buried below and acts as the primary coil. According to Faraday's law, the secondary coil, which is mounted in the car, interacts with the magnetic field produced by the primary coil to produce an electromotive force (emf). The secondary coil receives electricity from this emf, thereby charging the car's battery.

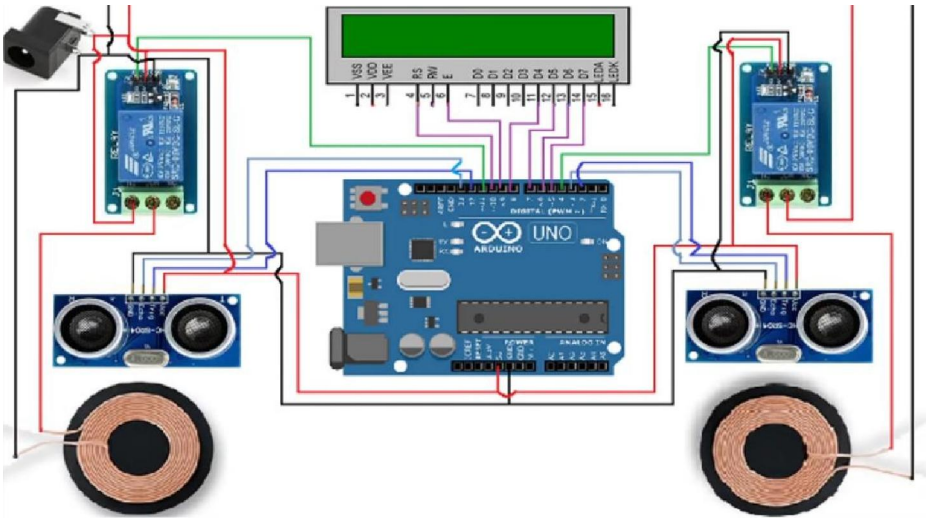
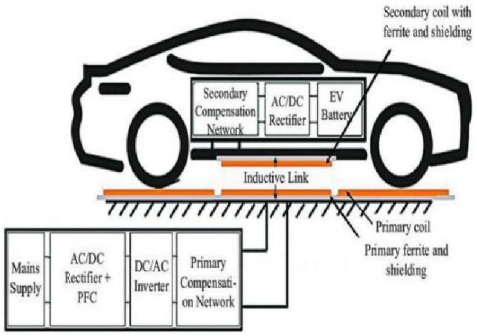


Figure 1: Circuit Diagram

V. RESULT

Electricity is transferred from the primary coil to the secondary coil (electromagnetic induction) in this wireless power transmission procedure, which is located in the vehicle's down side. The wireless charging station technique is made possible by the technology.



VI. CONCLUSION

In conclusion, wireless charging of electric vehicles with an Arduino Uno has the potential to completely transform the process and offer increased sustainability, efficiency, and convenience. Additional advantages of the technology include integration with renewable energy sources, remote monitoring and management of charging processes, and the removal of the need for cables and connectors. However, issues like the Arduino Uno's restricted communication range and the hefty implementation costs require more study and development. The adoption of Arduino Uno in electric car charging

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systems has the potential to aid in the shift to a more sustainable and clean transportation system with sustained innovation and funding.

VII. ACKNOWLEDGEMENT

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