e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:04/April-2025 Impact Factor- 8.187 www.irjmets.com

ELECTRIC VEHICLE WIRELESS CHARGING STATION USING ARDUINO UNO

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DOI : https://www.doi.org/10.56726/IRJMTES71637

ABSTRACT

Now that they are on the road globally, electric cars are gradually becoming more and more common. In addition to their positive effects on the environment, electric vehicles have helped lower travel expenses by substituting power for fuel, which is far less expensive. In order to lower the pollution emissions from non-renewable fossil fuel-powered vehicles and to offer an alternative to expensive fuel for transportation, the world is moving toward electrified mobility these days. However, the two main factors influencing the acceptance of electric vehicles over conventional vehicles are their traveling range and the charging process.

Thanks to the development of wire charging technology, you can now charge your electric car while you're traveling or simply park it in a designated location or garage. No more spending hours waiting at charging stations.

We are grateful to the great scientist Nikola Tesla for his countless incredible inventions, including wireless power transfer. In 1891, he began experimenting with wireless power transfer and created the Tesla coil. Tesla began building the Wardenclyffe Tower, a massive high-voltage wireless energy transmission station, in 1901 with the primary objective of creating a new wireless power transmission system.

Keywords: Electric Vehicle, Wireless Charging, Wireless Power Transmission, Arduino Uno.

I. INTRODUCTION

We created a wireless EV charging solution that uses both the grid and solar power. RFID is enabled on the system. Only those with a valid card are able to charge the car's battery. In the transportation industry, electric vehicles (EVs) are one of the most promising ways to increase economic efficiency and lower carbon emissions. Prior studies addressed the difficulties of incorporating this technology into electrical networks and concentrated on conductive and plug-in methods for EV charging.

Wireless charging systems come in two varieties.

Static and Dynamic Wireless Charging

Two types of EV wireless charging systems can be identified based on their intended use:

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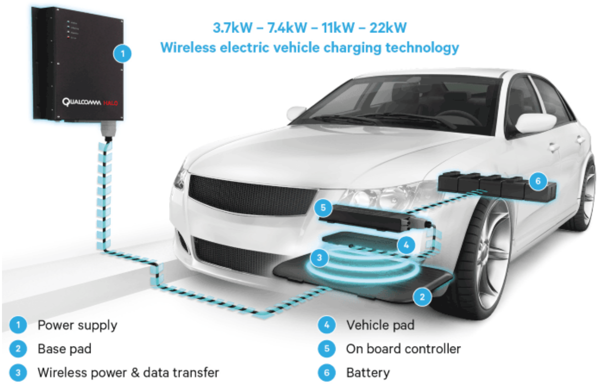
1.1 Static Wireless Charging

1.2 Dynamic Wireless Charging

1.1 Static Wireless Charging

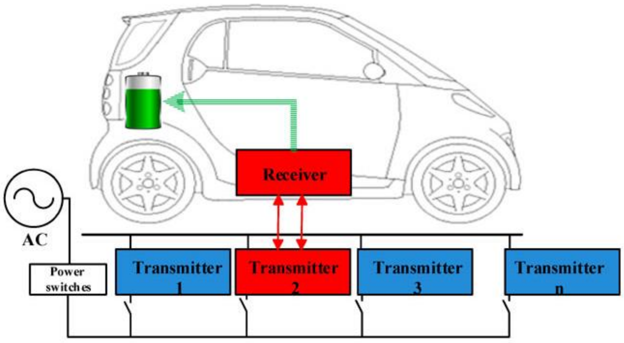
The car is charged when it stays motionless, as the name suggests. In this case, we could just park the EV in the garage or in the parking space that has WCS integrated. The receiver is set up in vehicles below, and the transmitter is installed beneath the earth. Align the transmitter and receiver, then let the car charge on its own. The distance between the transmitter and receiver, their pad sizes, and the power level of the AC supply all affect how long it takes to charge.

It is ideal to install this SWCS in locations where EVs are parked for a specific amount of time.



1.2 Dynamic Wireless Charging

As the name suggests, the car is charged while it is moving. A stationary transmitter sends power to the receiver coil in a moving vehicle via the air. By continuously charging its battery while traveling on roads and highways, DWCS EVs can increase their travel range. It lessens the requirement for substantial energy storage, which further lowers the vehicle's weight.



II. 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.

III. LITERATURE REVIEW

Electric vehicles can now be charged wirelessly without a plug. It won't be beneficial if each business creates wireless charging system standards that are incompatible with one another. Therefore, numerous international organizations, including the Society of Automotive Engineers (SAE), Underwriters Laboratories (UL), the International Electro Technical Commission (IEC), and the Institute of Electrical and Electronics Engineers (IEEE), are developing standards to make wireless EV charging more user-friendly.

WPT and Alignment Methodology for Light-Duty Plug-In EVs are defined in SAE J2954. The maximum input power allowed by this standard is 3.7 kW for level 1, 7.7 kW for level 2, 11 kW for level 3, and 22 kW for level 4. Additionally, when aligned, the minimum target efficiency needs to be higher than 85%. Ten inches of ground clearance and four inches of side-to-side tolerance are acceptable. The best alignment technique is magnetic triangulation, which helps autonomous cars locate parking spaces and helps manual parking vehicles stay within charging range.

EV/PHEV Conductive Charge Coupler is defined by SAE J1772.

Communication between wirelessly charged vehicles and wireless EV chargers is defined by the SAE J2847/6 standard.

The definition of EV Inductively Coupled Charging is found in SAE J1773.

Use Cases for Wireless Charging Communication for PEVs are defined by the SAE J2836/6 standard.

The Outline of Investigation for WEVCS is defined in UL topic 2750.

EV WPT Systems General Requirements are defined in IEC 61980-1 Cor.1 Ed.1.0.

WPT-Management: Multiple Device Control Management is defined in IEC 62827-2 Ed.1.0.

The WPT-Air Fuel Alliance Resonant Baseline System Specification is defined in IEC 63028 Ed.1.0.

IV. METHODOLOGY

1. Designing the Transmitting Coil: The electric vehicle's transmitting coil is made to create a magnetic field that can wirelessly transfer electricity to the receiving coil.

2. Receiving Coil Design: The receiving coil is made to wirelessly absorb power from the transmitting coil and transform it into electrical energy that can be used to recharge the battery of an electric car.

3. Power Electronics: The transmitting and receiving coils' power transfer is managed by the power electronics. The power electronics must be able to track the power transmission and modify it in response to the electric vehicle's charging requirements.

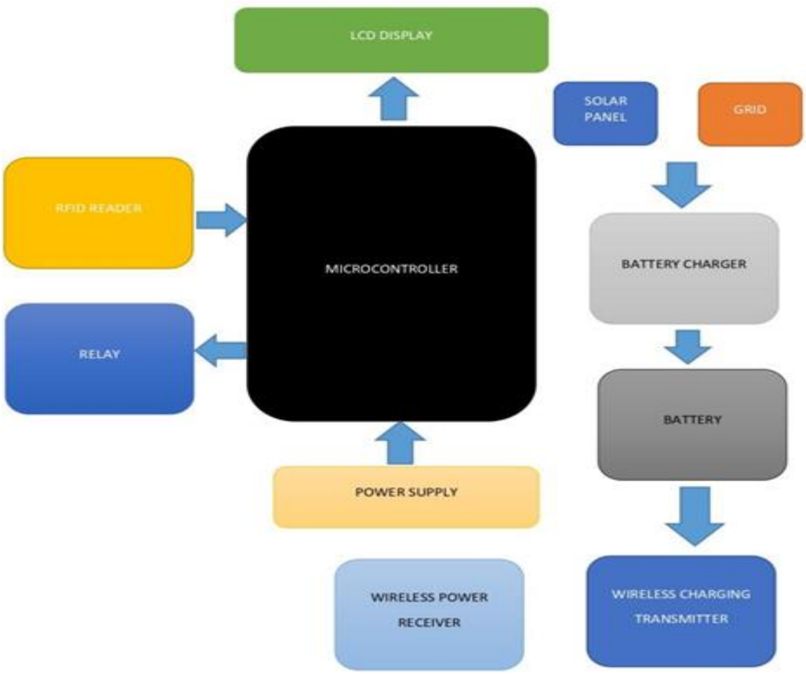
4. Safety Features: To guarantee that the charging process is secure for both the user and the environment, the wireless charging system needs to have safety features. This covers functions like temperature monitoring, overvoltage protection, and overcurrent protection.

5. Implementation: Electric vehicles and charging stations can use the system after it has been developed and tested. Both the transmitting and receiving coils must be installed in the charging stations and electric cars, respectively.

6. Testing: To make sure the wireless charging system is dependable, effective, and secure, it needs to be put through a rigorous testing process. It is necessary to evaluate the system's performance in a variety of scenarios, including varying power levels and separations between the transmitting and receiving coils.

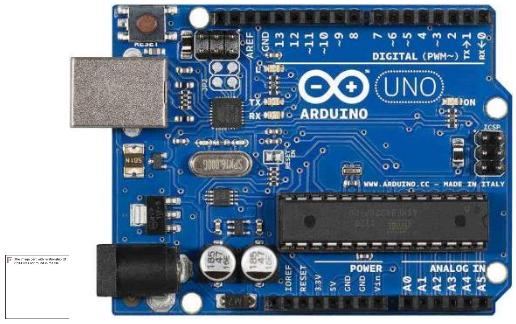
V. BLOCK DIAGRAM

5.1 Block Diagram of EV Wireless charging Station Using Arduino Uno

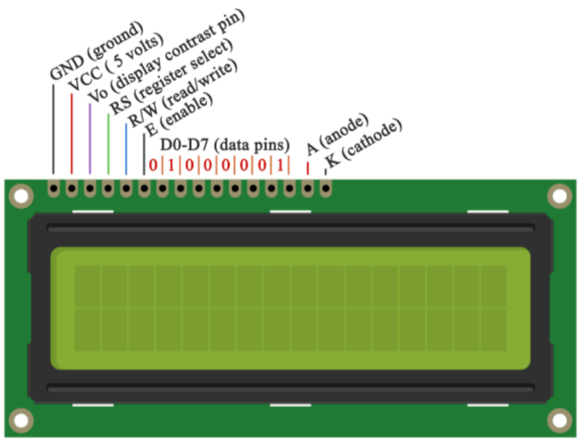


VI. HARDWARE REQUIREMENT

a) 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.

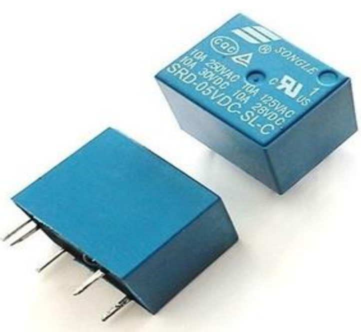


b) LCD Display: An electrical display module with many uses is the LCD (Liquid Crystal Display) screen. A 16x2 LCD display is a relatively basic module that is frequently seen in many different circuits and devices. Compared to seven segments and other multi-segment LEDs, these modules are recommended. The reasons are as follows: LCDs are affordable; they are simple to program; they can display animations, unique and even custom characters (unlike in seven segments); and so on.



There are two lines of 16 characters each, which is what a 16x2 LCD can display. Each character is shown in a 5x7 pixel matrix on this LCD. Command and Data are the two registers on this LCD.

c) Relay: By detecting a change in the circuit it is connected to, the relay is a device that allows an electrical circuit to be controlled (opened or closed). The electromagnetic relay in this circuit is utilized to turn the device on or off. It operates via the electromagnetic attraction and induction principles.



d) Battery: We are using sealed lead acid rechargeable batteries in this project. The oldest rechargeable battery still in use is lead acid, which was also the first to be used commercially. In essence, there are two battery sets: one that is initially charged and provides power to the motor, and another that is initially drained and serves as a power storage device. Three 4V batteries connected in series make up a single battery set.

e) 11.0952 MHZ CRYSTAL OSCILLATOR

It offers clock pulses at a frequency of 11.0952 MHz. It can function as a 6x1.8432 MHz UART clock. Integer division to ordinary baud rates (96×96×1,200 baud or 96×115200 baud) is possible. It is an Intel 8051 microprocessor common clock. It generates an electrical signal with a very specific frequency by using the mechanical resonance of a vibrating piezoelectric crystal.

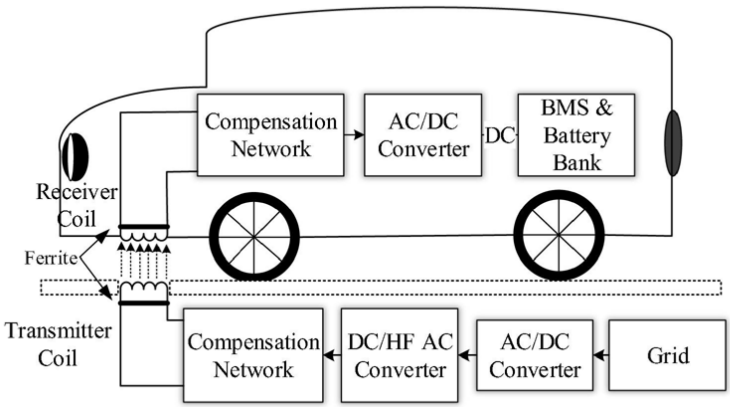
VII. WORKING OF PROJECT

The LCD displays the "Welcome" message when we turn on the project's power source.

The wireless charger circuit stays off at first because the relay is in an OFF state.

Waiting for the RFID code is the microcontroller. The RFID reader provides the microcontroller with its unique code each time a user scans their RFID card. The microcontroller then makes a comparison between the new code and its database. The relay and, eventually, the wireless charger circuit are turned on instantly if the codes match. The Vehicle Number appears on the LCD simultaneously. After a while, the wireless charger circuit is disconnected and the relay is turned off. The charging status is also displayed on the LCD.

No action will be taken if the RFID code does not match the internal database. With a single selector switch, the user can choose between a solar panel or the grid as the charging source, and the main battery is always in charging mode.



VIII. RESULT

Enhancing control efficiency, energy systems, and communication techniques have been the main goals of research on Arduino UNO-based wireless charging systems for electric vehicles (EVs). According to studies, the dual-coil technology with adaptive frequency control improved power transfer by keeping the coils in sync, even if they weren't quite aligned. Platforms based on Arduino UNOs have proved crucial for testing and development since they allow real-time monitoring of system characteristics like voltage and temperature. Additionally, they enable dynamic range changes for the inverter, guaranteeing peak performance when charging. To improve data transfer and guarantee system security, network protocols such near field communication (NFC) and power line communication (PLC) have also been added.Even with these developments, there are still issues with cost reduction, technological scaling, and keeping precise alignment. Recent studies, however, have indicated encouraging potential for combining wireless charging systems with autonomous cars and smart grids. Standardization will be essential going ahead to guarantee interoperability across various EVs and infrastructure, which is essential to facilitating wider adoption. All things considered, the Arduino UNO has proven to be a very useful tool for developing dependable and reasonably priced wireless charging systems for electric cars.

IX. FUTURE SCOPE

In light of current regulatory trends and developing technologies, this section attempts to envision the future of wireless electric vehicle charging, or WEVC. There are two primary concerns for WEVC systems as the global electric vehicle (EV) market continues to expand at an exponential rate: regulating the quick, occasionally unpredictable, evolution of EV technology and guaranteeing the sustainable expansion of EV adoption. Furthermore, WEVC may become even more competitive in the market with the introduction of novel materials, cutting-edge technology, and creative concepts. Additionally, WEVC systems' cutting-edge capabilities will be advantageous to the growing number of powerful electrical gadgets. But even with these improvements, energy waste is still an issue, and flux leakage and reversal losses are two major causes of inefficiency in the WEVC process.

X. CONCLUSION

Due to advancements in EV technology, charging infrastructure, and grid connectivity, EV popularity is predicted to rise significantly over the next ten years. Due to its vacuum operation, local independence, and spark-free nature, wireless charging has attracted a lot of interest in this area. EV wireless charging technology is explained in full in this document. This document provides a thorough explanation of EV wireless charging technology. Technology has the ability to lower life cycle costs, increase power efficiency, decrease environmental consequences, and improve operating convenience and security.

ACKNOWLEDGEMENTS

We are quite proud and delighted to exhibit our idea, "Electric Vehicle Wireless Charging Station Using Arduino Uno." Without the direction and assistance of our mentor, Prof. Dinesh Katole, this large project would not have been able to be completed, marking an important turning point in our academic careers. Her tremendous guidance and support during the production of this report are greatly appreciated. We were able to successfully complete our project because of Prof. Katole's commitment, tolerance, and excitement, which gave us direction and clarity. We would like to express our gratitude to every employee for their collaboration and support.

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