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Wireless Electric Vehicle Charging with Solar Panels

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Abstract:-

This paper presents an innovative design of a solar-powered electric vehicle (EV) charging station and addresses critical issues of fuel consumption and environmental pollution. With the global spread of electric cars, their environmental benefits and cost-effectiveness are increasingly recognized. The proposed electric car charging system offers a unique solution that enables wireless charging of vehicles without stopping and even while driving. The system runs entirely on solar power, so no external power source is needed. The report describes the design and engineering of a solar-powered electric car charger for built-in roads that provides a novel and efficient solution to two challenges. fuel consumption and emissions. The number of countries where electric cars are on the road is constantly growing. In addition to helping the environment, electric cars have proven useful in reducing transportation costs by replacing expensive fuels with cheaper electricity. The proposed electric vehicle charging infrastructure structure eliminates the need to stop for charging, as the electric vehicle can be charged on the go. The system runs on solar energy, which eliminates the need for an additional power source. This research will contribute to ongoing efforts to make electric car charging more efficient and environmentally friendly.

Keywords: Electric Vehicle, Wireless Charging, Solar Panels, Arduino Uno, Transmitter and Receiving Coils, LCD display, wireless Power Transfer

1. Introduction :-

In the field of transportation, electric vehicles (EV) are a revolutionary development. They are expected to dominate the car market in the near future. The charging process of electric cars must be controlled to maintain the quality of the electrical networks. Despite this, the growth of electric cars leads to significant amounts of energy stored in batteries, which allows the opposite effect. The interaction of electric vehicles is a defining technology in the intelligent networks of the future, which promotes network autonomy.Due to the reduction of carbon dioxide emissions and the increase in the price of fossil fuels, electric cars have become more competitive than traditional internal ones. combustion engine vehicles. However, due to the high price of the vehicles, the lack of fast charging stations and the scarcity of fully electric vehicles, electric cars have not been widely adopted in the market. There are two types of electric cars: fully electric and partially electric. In addition to low operating costs and low environmental impact, electric cars use little or no fossil fuels. The concept of wireless transmission to charge and operate motors and devices has been discussed since the time of Tesla.

However, it did not work then due to lack of technical support. In 2007, researchers made significant progress in that direction by directing light from a wireless source two meters away. Since then, significant progress has been made in this area. One of the many applications of wireless power transmission (WPT) is electric car charging, which offers many advantages and is currently being researched. The term "conductive charging system" refers to conventional wired or plug-in charging methods, which have some. of problems. They require bulky charging cables and a plug, and the charger must be manually connected to the power source and the product charged. A cable charging system is neither user-friendly nor environmentally friendly. Factors such as temperature, contact with the ground, or self-charging devices can cause the charging cable to short out or become damaged, which can cause an electric shock. WPT is another method that can be used to troubleshoot battery problems. For example, using a wireless charging system can reduce initial costs by avoiding large and bulky batteries. The WPT method is effective because it eliminates the clutter of cables and connectors that come with manual overhead systems.

2. Block Diagram :-

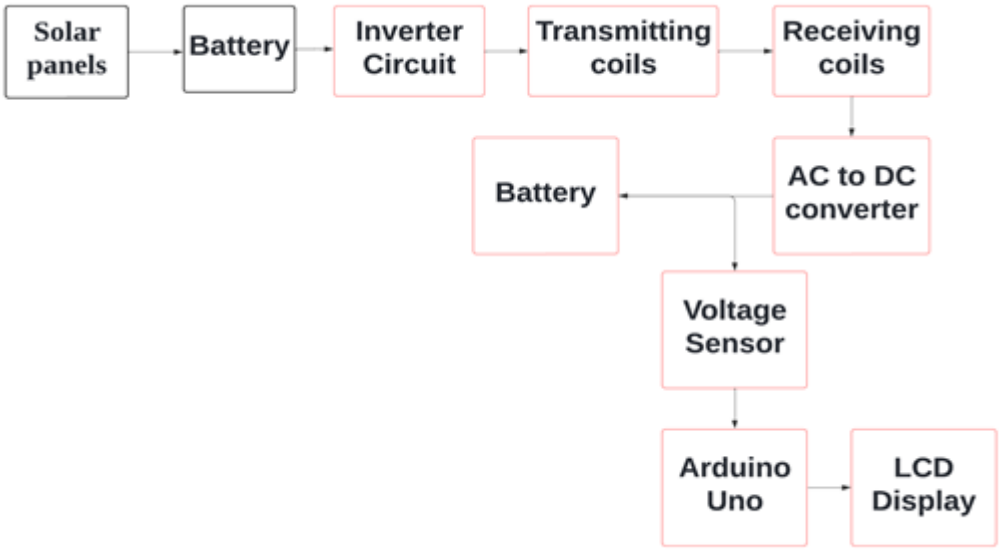
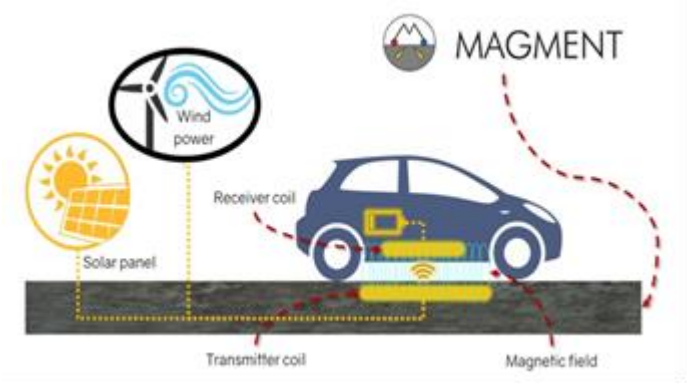


Fig. No. 1 – Block diagram of the project. Solar panels produce energy, stored in a battery. Through inverter circuits, it's wirelessly transmitted, converted to DC, processed by an Arduino Uno, and displayed on an LCD.

3. Working Priciple



Solar panels composed of photovoltaic cells use sunlight and convert it into electrical energy using the photovoltaic phenomenon. This generated power is stored in a battery, a device that stores energy in an electrochemical form, ready to be converted back into electricity when needed. The stored power is then transferred to the transmission coil via inverter circuits. Inverter circuits are electronic devices that transform the direct current of the battery to alternating current (AC). The transmitting coil, an integral part of the wireless power transmission system, creates a magnetic field when alternating current passes through it. This magnetic field is picked up by the receiving coil, which is tuned to the same frequency as the transmitting coil. The alternating current induced in the receiving coil is then converted back to direct current by rectifier circuits. This direct current is stored back in the usable battery. Power is then transferred to a voltmeter, a device that can measure the difference in electrical potential (also known as voltage) between two points in an electrical circuit. This sensor transmits the voltage data to the Arduino Uno, a microcontroller board based on ATmega328P, which processes the data. Finally the processed data, which can be the voltage level or other related data, is displayed on the LCD (Liquid Crystal). Screen), a type of display technology that uses the light-modulating properties of liquid crystals in conjunction with polarizers. This allows users to monitor system performance and take necessary adjustments or actions.

4. Hardware Description

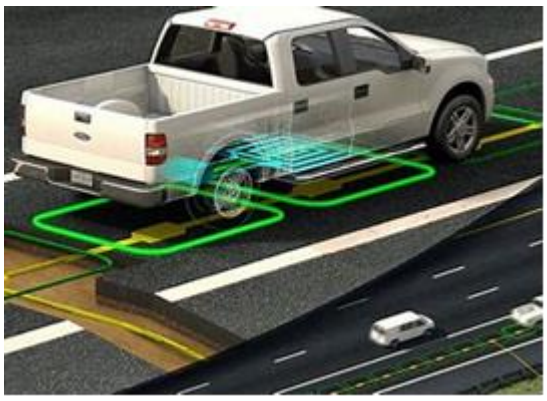
Arduino uno

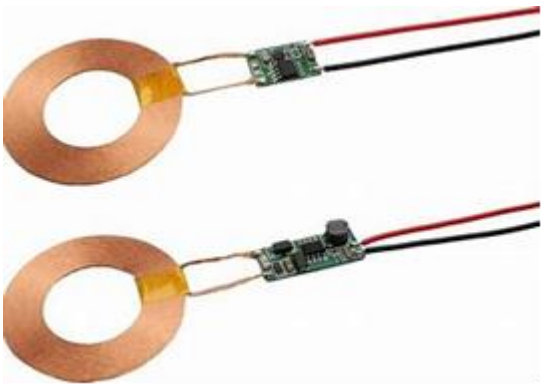
Arduino Uno, an open source microcontroller board, is the optimal choice for learning embedded system programming. Ideal for beginners, it provides a hands-on approach to understanding the complexities of hardware-software interaction. The entire layout and printed circuit board (PCB) schematic of this platform is available online, promoting transparency and ease of learning. In-depth tutorials on home automation and Internet of Things (IoT) projects with Arduino Uno are also widely available. The free software Arduino Integrated Development Environment (IDE) is used to program all Arduino boards. It supports multiple operating systems including Windows, Linux and macOS. In addition, there is speculation about the existence of third-party mobile applications that can program Arduino boards, increasing accessibility and convenience.

Features:

The operating voltage is 5V
The recommended input voltage will range from 7v to 12V
The input voltage ranges from 6v to 20V
Digital input/output pins are 14
Analog i/p pins are 6
DC Current for each input/output pin is 40 mA
DC Current for 3.3V Pin is 50 mA

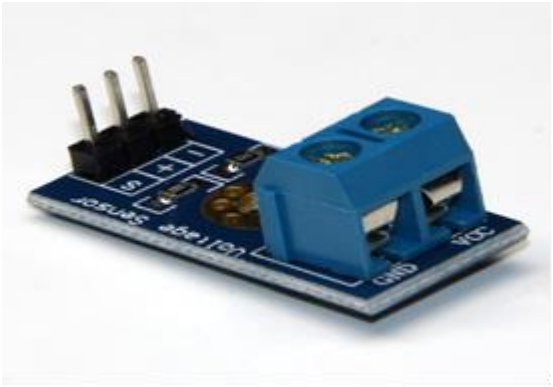
Transmitting and receiving coil





The operating principle of the transmitting and receiving coils is based on the concept of electromagnetic induction. A transmission coil supplied with alternating current creates a magnetic field that oscillates at the same frequency as the current. When the receiving coil is placed in this oscillating magnetic field, its magnetic flux changes. According to Faraday's law of electromagnetic induction, this change in magnetic flux induces an electromotive force (EMF) in the receiving coil, which results in a current when the closed path is used. In this way, power is transferred wirelessly from the transmitter coil to the receiver coil. The efficiency of this transmission depends on factors such as the distance between the coils, their alignment and their structural characteristics.

Voltage Sensor



This sensor is used to monitor, calculate and determine the supply voltage. This sensor can determine the AC or DC voltage level. The input of this sensor can be voltage, while the output can be switches, analog voltage signal, current signal, audio signal, etc.

LCD Display

The 16x2 LCD screen, illuminated with yellow and blue backlight, is a versatile component for Arduino-based systems. It is easy to interface with microcontrollers that act as a powerful printing device. The screen can display plain text or numerical information that can be obtained from various sensors, such as temperature or pressure sensors. It can also report the number of Arduino execution cycles and provide real-time insight into system performance.

5. Advantages and Disadvantages

Advantages

1. Environmentally friendly
2. Compared to other fuel vehicles, running costs are 80% lower.
3. Requires less maintenance than a gas vehicle.
4. Clean and light vehicles and Electronically protected.
5. Download is practical and Several electric cars can be charged at the same time.

6. Quieter than other normal cars in the wild.

Disadvantages

1. Limited range and capacity

2. It is expensive

3. Charging requires downtime

4. Insufficient power sources

5. Battery maintenance is expensive.

6. Result

• Increased convenience for EV owners: drivers can charge their vehicles while driving, eliminating the need to stop at charging stations as often.

• Better range and efficiency: continuous charging on the go can extend the range of EVs and improve them. more practical. for longer trips.

• Fewer infrastructure requirements: With wireless charging integrated into roads, the need for traditional charging infrastructure is reduced, which can reduce costs and land use.

• Electric vehicle has improved: wireless charging on roads can reduce. distant anxiety and infrastructure constraints that encourage people to switch to electric cars.

• Environmental benefits: By promoting the use of electric cars, the project reduces greenhouse gas emissions and dependence on fossil fuels.

• Technical advances: Development and implementation of wireless devices. Road charging technology is an important step forward towards a sustainable transport infrastructure.

7. Future Scope

As the electric vehicle (EV) market expands, the importance of wireless electric vehicle (WEVC) systems will continue to grow. The integration of new technologies and materials is poised to improve WEVC's competitiveness and meet the twin challenges of energy efficiency and adaptability. Modern electrical electronics using advanced materials can reduce energy losses due to switching and current leakage common in current WEVC systems. The advent of dynamic WEVC offers a transformative approach to electric vehicle charging, allowing vehicles to be charged on the go. the need for permanent charging stations disappears. This technology not only simplifies the loading process, but also paves the way for several applications beyond transportation, including biomedical implants, hyperloop travel and robotics. The future of WEVC is its scalability and sustainability, which is compatible with industrial growth and environmental policies. As cities and countries prepare for an electrified future, WEVC's role is crucial in ensuring a smooth transition to e-mobility. The potential of this technology extends far beyond transportation and offers unlimited opportunities for innovation and progress in various fields.

8. Conclusion:

In conclusion, wireless charging of electric vehicles (EV) via solar road systems offers a sustainable transportation solution. Harnessing solar energy and transferring it to electric vehicles while traveling solves remote anxiety and the need for regular charging stations. Solar panels integrated into roads efficiently convert sunlight into electricity, which is transmitted wirelessly to vehicles using inductive charging technology. This reduces dependence on non-renewable energy and increases the convenience of charging electric cars, which promotes the widespread adoption of electric mobility. Using renewable energy and wireless charging also reduce greenhouse gas emissions. Successful implementation requires collaboration between stakeholders to address technical, legislative and financial aspects. Wireless charging of electric cars powered by solar energy integrated into roads is a significant step towards sustainable and emission-free transport networks.

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