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Solar Wireless Electrical Vehicle Charging System

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Abstract: Electric vehicles are becoming more popular as an alternative to conventional gasoline- powered vehicles. In order to strengthen charging infrastructure, dynamic wireless charging (DWC) is apromising technology through which the vehicle battery can be continuously charged while the vehicle is in motion. The main challenge of the DWC system is to investigate the capability for power transfer with the variation in operating parameters in consideration of enhanced efficiency. This project proposes an innovative approach to improve the performance of dynamic wireless charging systems by investigating the magnetic coupler via finite element analysis, exploring power pulsation and mutual inductances with variations in longitudinal, lateral, and air gap distances as variable factors. In addition to this, efficiency analysis is also explored with respect to the mutual inductance and various compensation schemes. The simulation studies are carried out using computer-assisted software, i.e., MATLAB version2022b. Finally, a comparative analysis of power transferred, mutual inductance, and efficiency is presented by the compensation schemes.
Keywords: Transmitter and Receiver coil, Arduino UNO, Solar panel, Bluetooth Module.

I. INTRODUCTION

In recent years, the widespread adoption of electric vehicles (ev's) has gained significance as a promising solution to mitigate environmental pollution and reduce dependence on fossil fuels. However, one of the key challenges that hamper the extensive acceptance of ev's is the limited driving range and the inconvenience associated with recharging the vehicle's batteries. Traditional plug-in charging methods require a physical connection between the vehicle and the charging infrastructure, leading to issues such as limited flexibility, safety concerns, and user inconvenience. Currently, wireless chargers are also emerging in bidirectional modes for vehicle to home applications.

Dynamic wireless charging (DWC) technology has emerged as a potential solution to address these limitations. DWC enables the charging of ev's through an electromagnetic coupling between charging infrastructure installed on the road surface and a receiver unit embedded in the vehicle.

This technology allows for charging on the go, eliminating the need for frequent stops at charging stations and extending the range of ev's. However, the practical implementation of DWC faces several technical challenges that need to be addressed to ensure its enhanced performance and widespread deployment. Power pulsation within the dynamic wireless charging (DWC) paradigm pertains to the non-uniform and oscillatory characteristics exhibited by the power exchange between the charging infrastructure and the electric vehicle throughout the charging process.

From the literature it is found that compensation schemes are used to mitigate power pulsation in DWC systems. However, only mitigating power pulsations with compensation schemes might not provide a holistic solution. The matter of power pulsations represents a significantly grave apprehension which has garnered considerable scrutiny within the realm of research, owing to its intricate and interconnected relationship with the deployment of wireless power transmission systems across various avenues. Power pulsation in dynamic wireless charging (DWC) systems has a significant impact on the charging efficiency and performance of EV batteries.

Understanding these effects is crucial for the design and optimization of DWC systems to ensure reliable and efficient charging for electric vehicles on the move.

II. PROBLEM STATEMENT

The current charging system for electric vehicles involves the use of cables and plugs, which can be inconvenient and messy, especially when charging vehicles. The goal of this project is to develop a wireless charging system for electric vehicles while running that eliminates the need for stopping vehicle for charging, cables and plugs, making the charging process more convenient and efficient.

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III. PROPESED SYSTEM

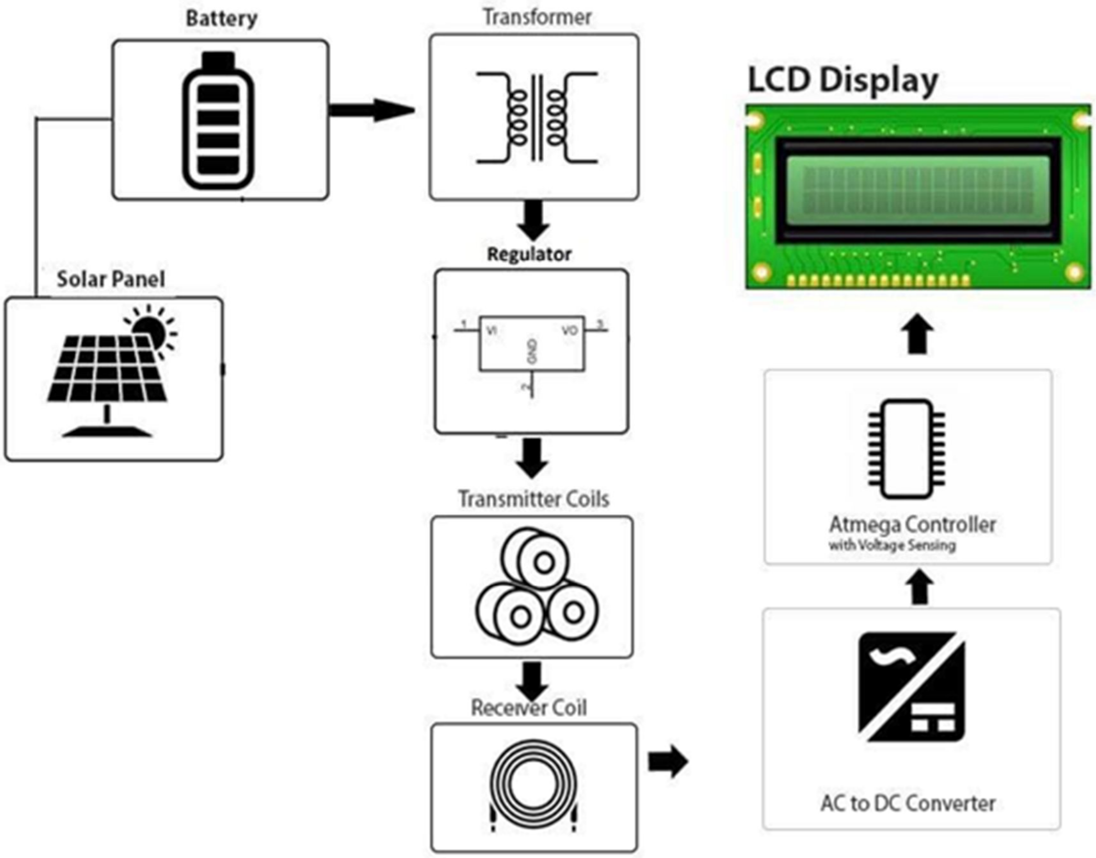

Figure 1.1: Block Diagram

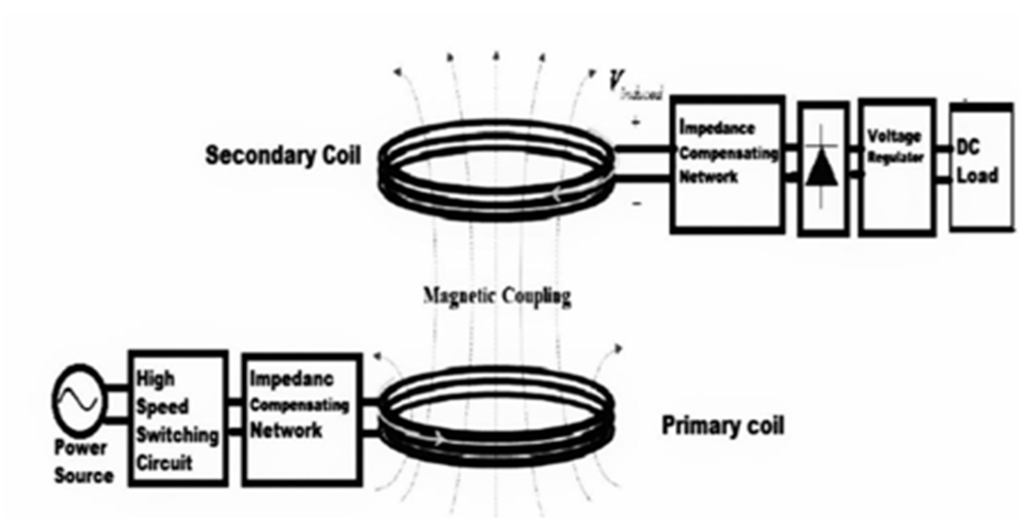

Figure 1.2: Schematic Diagram Of Wireless Power Transmission System

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IV. METHODOLOGY

In terms of complexity, the proposed vehicle is simple. Construction-wise, it's a breeze compared to gas-powered cars. Design of an electric car. Two motors and their controllers, a reversing circuit, a battery pack, a solar photovoltaic (PV) module with a charge controller, and a speed controller are the essential components both controllers share a common accelerator to trigger. When the brakes are applied, the motors will stop running because of the brake switches. When you turn the car in the opposite direction of a motor, that motor will shut down. To accomplish this while the vehicle is in motion, the two phases and two control wires are switched.

The reverse button is conveniently located on the steering column. To eliminate cumbersome cords, magnetic resonance technology has enabled wireless power transmission (WPT). Actually, the WPT uses the same fundamental principle as inductive power transfer, which has been studied and refined for at least three decades.

As a field, WPT has seen remarkable advancement in recent years. power in milliwatts to kilowatts, the power transfer distance grows from a few millimeters to a few hundred millimeters at a load efficiency of higher. With these improvements, the WPT is increasingly appealing for use in stationary and dynamic EV charging applications.

The technologies discussed in this session that can be used for EV wireless charging can be found in the Wide Power Transmission (WPT) domain. The problems of limited range, high costs, and inconvenient charging for EVs can be readily overcome with the implementation of WPT.

Electric vehicles (EVs) have reached critical mass, and battery technology is no longer a limiting factor. We anticipate that researchers will be inspired by the state-of-the-art results and will use this motivation to further WPT and EV.

V. HARDWARE COMPONENTS

1) *Solar Panel:* This is a high-performance, lightweight, portable monocrystalline silicon solar panel in a PET package, with an integrated voltage regulator output of 5V, with working indicators, USB type-A mother-port output, plug-and-play. It can supply plenty of power in various environments to prevent the system from shutting down, even in rainy days.. The ultra-thin, lightweight design weighs just 90g. It's much lighter than a solar panel in a traditional glass package.
2) *Battery:* Hi-Watt 9V batteries are rechargeable, leak proof, and corrosion-free. They can be used in flashlights, sensor devices portable phone chargers, wireless doorbells, wireless audio transmitter-receiver systems, toys, and sensor devices.
3) *Arduino uno:* When learning how to code for embedded systems, the Arduino Uno is the best board to use. This Arduino Uno board is great for tinkering if you're just getting started in this industry. The whole PCB layout and schematic for this open-source Arduino platform is available online. An extensive Arduino Uno home automation and Internet of Things project lesson may also turn up in a web search. The Arduino Software Development Environment (IDE) is used to program all Arduino boards and is available at no cost. The Arduino Software Development Kit (IDE) is available for download on Windows, Linux, and Mac computers. There are rumors that there are third-party mobile apps available for programming Arduino Boards.
4) *Motor Drive:* This is the popular L298N Dual H-Bridge Motor Controller, typically used to control motor speed and rotation direction. It can also be used for other products such as with LED arrays, relays, and solenoids, etc. It’s a powerful little motor driver with a heavy duty heat sink. Capable of powering 5-35V motors with a max of 2A. We’ve used up to 4 motors using the 6 onboard screw-terminals. It has an onboard 5V regulator that can output up to 1A with components with 5V power requirement. Don’t use the 5V regulated power when supplying more than 12V to motors.
5) *Transmitter and Receiver Coil:* The 5V 2A wireless transmitter receiver charging coil module is for a variety of small electronic products, wireless charging, power supply development, and design, with a small size, easy to use, high efficiency, and low price characteristics. It is mainly used in mobile electronics products such as for charging mobile phones and electronics gadgets wirelessly. The adoption of a Contactless charging power supply can be used to sealing of the products to make them waterproof and dustproof and increase product service life to make it more convenient.
6) *LCD Display:* LCD stands for Liquid Crystal Display. It is a flat panel display technology that uses a layer of liquid crystals to produce images or text. LCDs are used in a wide range of electronic devices, from smartphones and televisions to digital watches and calculators.
7) *Bluetooth Module:* The HC05 bluetooth module is used as UART serial converter module and can easily transfer the UART data through the wireless bluetooth. The Bluetooth module has a Frequency: 2.4GHz ISM band, PIO control and comes with an integrated antenna and edge connector.

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VI. HARDWARE SETUP

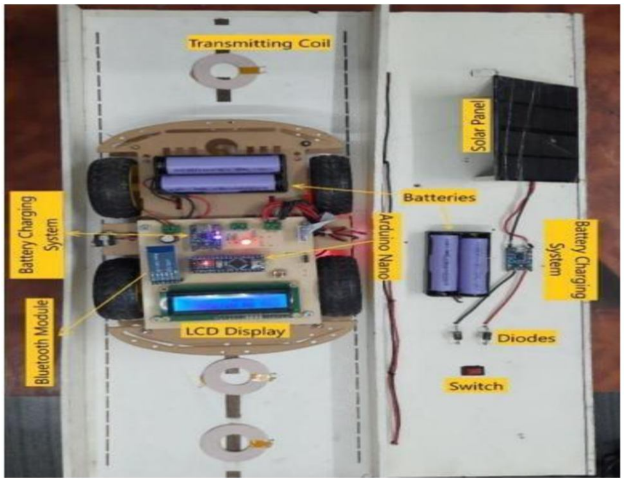

Figure 2.1 Hardware Transmitter Side

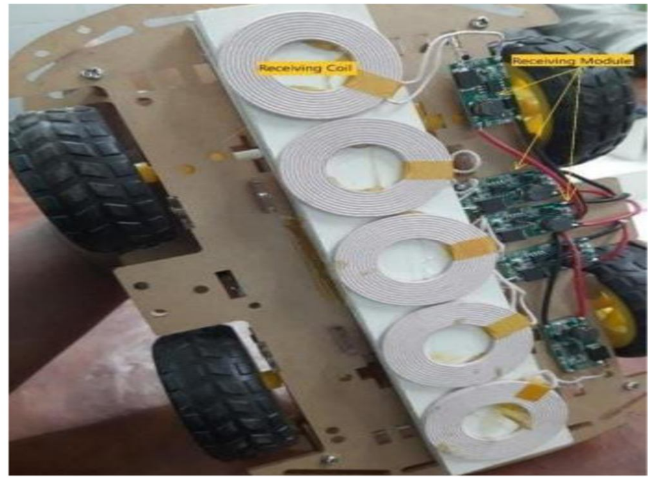

Figure 2.2 Receiver Side

VII. RESULT AND DISCUSSION

Conductive charging refers to the more common place connected or plug-in methods of power delivery. However, there are a few issues with these hardwired charging methods. As an illustration, they need bulky charging cables and plugs. Furthermore, the tethered charging solution is not pleasant to either users or the environment. Using a large number of batteries or exchanging spent ones for fresh ones can cut down on charging time and the associated risks. If a specific quantity of batteries allows a car to drive a certain distance on a single charge, adding more batteries will expand the car's range. Alternately, at charging stations along the route, the vehicle's batteries can be swapped out for fully charged ones. But the batteries have their own issues. The batteries are expensive to buy and cumbersome to carry around, but they only last a short time before they need to be replaced. If energy storage devices can be improved in the future, maybe we can solve these issues. However, the WPT is another option for addressing the batteryrelated issues. Use of the dynamic wireless power charging system, for instance, can eliminate the need for large, heavy batteries and lower the whole system's entry price. As a result of not having to deal with the clutter of wires and connectors typically found in manually plugged-in charging systems, the WPT technique is also very practical and user-friendly. As a result of its potential utility in many different industrial and engineering contexts, WPT and its practical implementations are the subject of extensive research. Application areas for WPT include electric cars (EVs), electronic gadgets.

VIII. CONCLUSION

Electric vehicle (EV) wireless charging technology could provide the EV industry a clear advantage. Wireless charging provides many benefits, including increased comfort, ease of use, and reduced wear and tear on charging ports, even if wired charging is currently more prevalent. Therefore, improvements in wireless charging technology may significantly enhance the EV charging experience and speed up EV adoption, which may finally result in a decrease in the waste products of fossil fuel use and contribute to the mitigation of climate change. A solar power wireless charger can efficiently charge the battery with nearly little wires. Cell phones and other wireless gadgets, as well as the vast majority of small electronics, are ideal candidates for this wireless charging technique. This experiment depends on wireless technology and solar electricity. Electronic items can then be readily charged without a wire or charger when traveling and during load shedding. This system thrives in a good environment and produces a lot of material.

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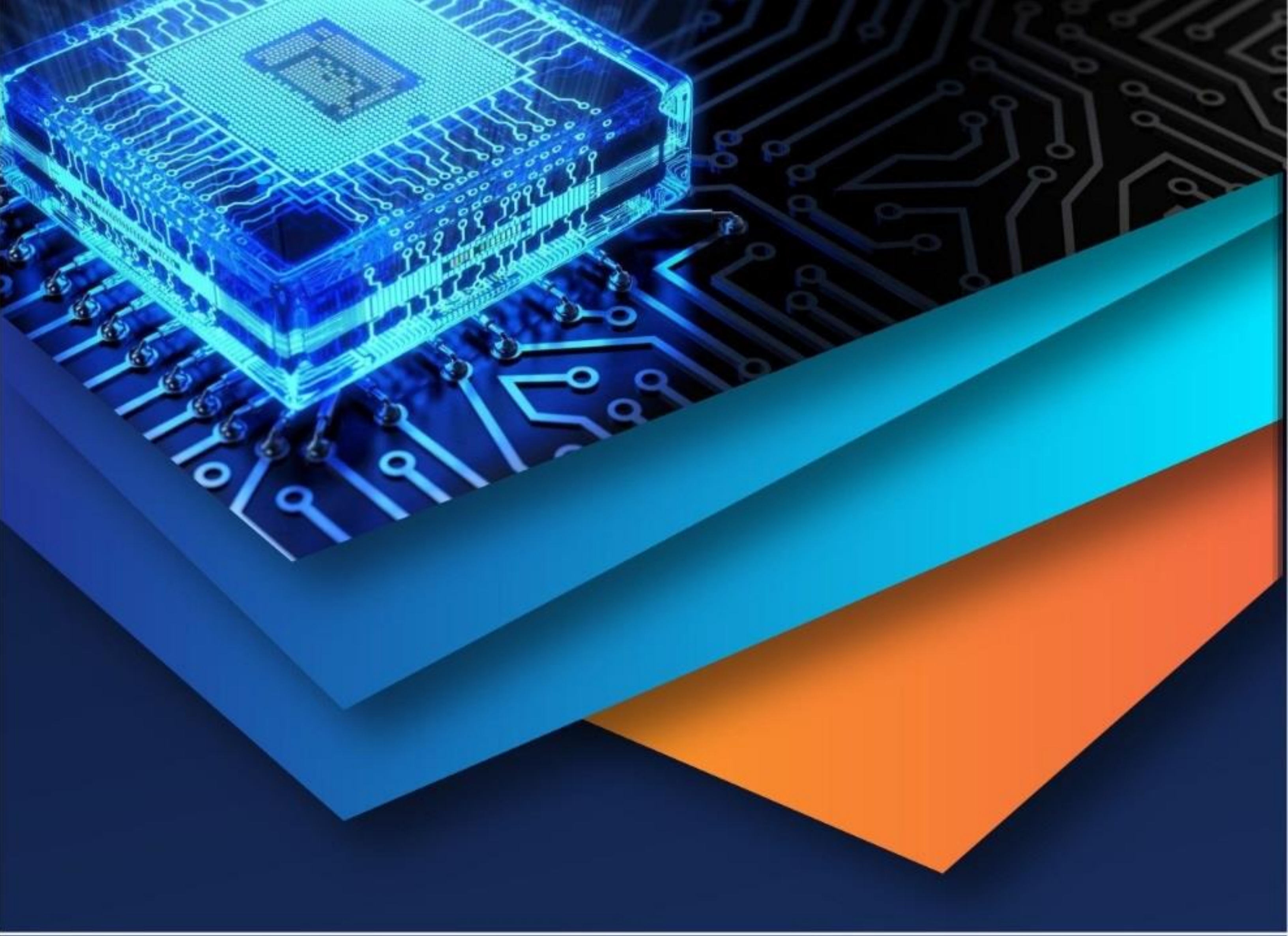

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