A Comprehensive Guide of Wireless Energy Transfer

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ABSTRACT:

Our usage and access to electricity have changed dramatically as a result of wireless energy transfer's ability to unleash power. There are countless possibilities now that energy may be transferred wirelessly by using transmitter and receiver components. The receiver side has a receiver coil, AC to DC converter, battery, PIC controller, PWM driver, LCD, and Internet of Things (IoT), whereas the transmitter side is made up of parts such an AC supply, DC to AC converter, AC to DC converter, and a transmitter coil. With the use of this technology, traditional wires connections are no longer necessary, offering a more convenient and safe option. Wireless energy transfer has revolutionized the telecommunications, transportation, and healthcare industries due to its short-range energy transmission capabilities. It makes it possible for electronic gadgets to be charged effectively, powering.

I.INTRODUCTION:

The need to develop alternate energy generation systems has arisen due to resource scarcity. Thus, wireless power transmission, or WPT, is a convenient, affordable, and noiseless charging method. An estimated 20–30% of losses are attributed to cables.

Therefore, WPT aims to reduce these losses as well as pollution levels brought on by current resource usage. Electronic portable gadgets can be charged via wireless power transmission. The designs of SPS are mostly derived from WPT.Currently, nevertheless, the main use is for charging electric vehicles, such as cars, planes, and rockets that run on no fuel. The fundamental idea behind inductive WPT The inductor has two elements when it comes to charging. The inductor functions as the transformer's primary winding in half and its secondary winding in the other half. The charger's job is to transform low-frequency AC electricity into high-frequency AC power. From the charger, high frequency AC is sent to the secondary side, where it is

transformed into DC power and fed into the battery pack.

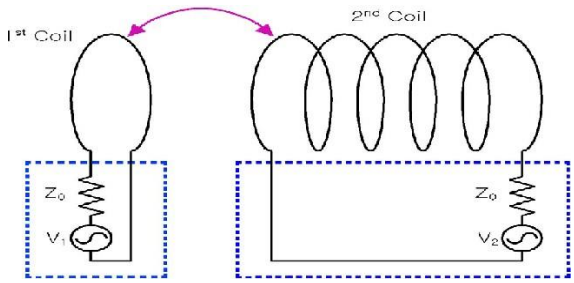

Fig. 1 Schematic of a transformer where Zo is the characteristic impedance and V1 and V2 are the voltages as shown.

The following firms and groups produce electric vehicles using wireless charging systems: \ Auto OEMs, such as GM, Audi, BMW, Chrysler, Daimler, Ford, Mitsubishi, Honda, and Toyota; Tier 1 automotive suppliers, such as Delphi, Magna, Maxwell, and Panasonic. Currently operating WPT providers include: Evat ran, WiTricity, LG, Conductrix Wampler and numerous others. The most well-known example of wireless technology is the Tesla tower, which Nikola Tesla built in an effort to transmit power wirelessly. The phenomenon of dissemination in all directions caused him to fail. Japanese scientists are planning to test a similar show at the Tokyo Tower. One of the first WPT tests was suspending a lightbulb two meters away from the transmitting coil in space. With developments in the Vehicles can be powered by electricity through resonant coupling. One way to understand resonance's power is to compare it to that of an opera singer. The glass breaks into fragments as a result of the magnified vibration when the singer's frequency coincides with the glass's inherent frequency.

II. PROPOSED SYSTEM:

A suggested WPT converter is a straight AC-AC (cyclo-converter). It has been demonstrated that the converter's structure is less complicated than that of a conventional AC-DC-AC converter. Based on the WPT idea, there are numerous AC-AC converter topologies. Our purpose is to use UF diode in AC-AC (Cycloconverter). For unidirectional power transfer, a bi-directional converter is also introduced. We employed lithium-ion batteries for charging in our suggested solution.

III. BLOCKDIAGRAM:

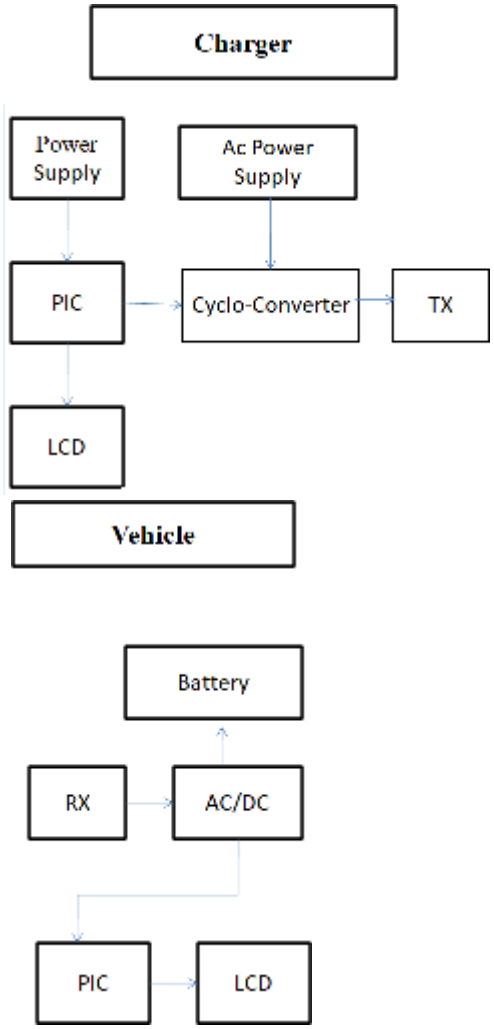

Fig.2General IMC-WPT Block Diagram

IV. EXPLANATION:

The air conditioner dc PFC circuit helps this proposed WPT framework convert the air conditioner supply to low level de supply. Then, the dc supply is provided to the high recurrence exchanging devices. The necessary side twisting will be initiated by the swapping device. by the delicate exchanging system. The auxiliary winding on the framework's optional side is able to obtain the moved power from the essential side. From then on, the power is transferred, with the aid of an AC-DC converter, to a DC structure for the purpose of charging the batteries.

V. BASIC PRINCIPLES FOR WIRELESS POWER TRANSMISSION:

Over the past ten years, a lot of study has been done on wireless power transmission. Energy transfer processes allow it to be divided into radiative and non-radiative categories. An antenna is used to transfer radiation power in the form of electromagnetic waves. However, because electromagnetic waves can move in any direction, Low energy efficiency is the result. The magnetic coupling of the conducting loops is the foundation of non-radiative power. There are two types of non-radiative power transmission: mid-range and short range. The term "mid-range WPT" refers to transmission distances longer than the diameters of the resonating coil.

Three fundamental components of WPT are:

1. The working and driving circuits are inductively coupled.
2. Circuit tuning, or "oscillation transformer " tuning.
3. Open circuit loaded with capacitance.

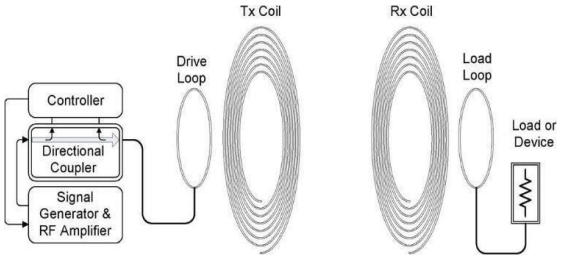

Fig. 3 Magnetically coupled WPT system

The RF amplifier creates a magnetic oscillating field that excite the Tx coil and supply power to the drive loop. Beside the single turn drive loop is the multiturn spiral coil known as the Tx coil. The system functions as a transformer step-up. Because of the one turn load loop linked to the device, the receiving side of the identical arrangement now functions as a step-down transformer. The mutual inductance between the Tx and Rx coils depends on their respective geometries and distances from one another. Large air gaps allow for the transmission of power when the transmitting and the resonant frequency of the receiving coil is the same and it is in resonance. The additional method and explanation that allow for transmissions are as follows:

Coupling theory:

As seen in Fig.3 this technology operates on the mutual inductance principle through a two-part transformer. A change in current flow through one winding causes an electromagnetic induction to induce a voltage across the ends of the other winding. the coupling of two conductors through induction.

Structures with Windings

Because there is no metal-to-metal contact, the location and shape of the magnetic core become crucial, and windings are essential to effective power

transfer. Recent advancements have greatly enhanced magnetic circuit development for linking on-vehicle pads to ground-based pads with higher efficiency. When compared to previously created pads, newly developed polarized pads function better.

Inductive WPT:

The GM EV1 is one of the EV systems that successfully uses inductive power transfer, or IPT. The secondary is implanted in epoxy, while the mange, also known as the primary, is the charging paddle. Without any contacts or connectors, the charging of the EV1 starts at either 6.6 kW or 50 kW when the charging paddle is placed in the middle of the secondary coil. Although it lacks connectors, this technology is not wireless.

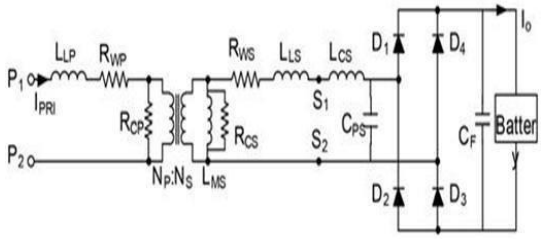

Fig. 4 Inductive interface (paddle) equivalent circuit.

Capacitive WPT:

As an alternative to contactless power transmission, capacitive wireless power transfer, a recent technological endeavor, has been suggested. With the CPT interface situated between two coupling capacitors, the construction is identical to that shown in fig. The structures of the inverter and rectifier, among other components, have not changed. At a certain power level, magnetics does not scale down as intended with decreasing power. A capacitive interface can reduce the size and expense of the galvanic isolation components. High Power applications, however, do not like this technique. And as a result, the majority of CPT solutions currently in use are utilized in portable electronic devices and low power applications, like wireless cell phone chargers and tooth brush chargers.

Power transfer via low frequency permanent magnet coupling (PMPT):

Synchronous permanent magnet electric machines and magnetic gears are two examples of the components that make up low frequency PMPT. Its two primary physical components—which are depicted in the figure—are as follows:

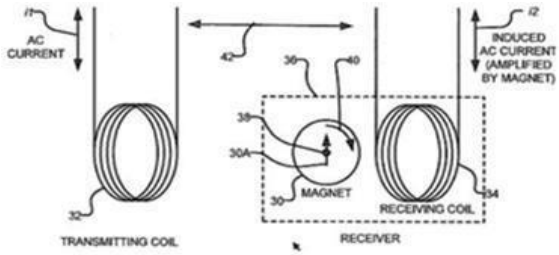

Fig. 5 Increasing the inductive power transfer between two coils by using a rotating magnet

PMPT transmitter:

An external, self-contained motor or static windings placed around the rotor's circumference, separated by an air gap and situated either inside the rotor or outside in the case of a hollow rotor, are the two ways in which a cylindrical, permanently magnetized rotor is driven.

PMPT Receiver:

During charging, a rotor akin to this one on the car is positioned 150 mm in front of the utility-side installation. The vehicle rotor will typically rotate at the same speed as the utility-side rotor due to

the interaction of the two rotors' magnetic fields. The magnetic gear effect is this.

APPLICATION:

Industrial Applications: Wireless charging of remote sensors and gear is a common practice in industrial applications, particularly for portable devices. Cell phone charging, autonomous aircraft, household appliances, and electric cars: The charging framework for smaller gadgets includes power chairs and a charging cushion where the user may place items like cell phones and revolving brushes.

Therapeutic inserts, such as pacemakers, subcutaneous medicine supplies, and various inserts, must be charged and functional. The incorporation of external charging connections and the favourable continual charge of these inserts are made possible by WPT, especially when it comes to high reverberation. This eliminates the need for medical visits. Wearables charging: Portable wearable systems are also charged wirelessly. The system uses a capacitive coupling-based technique to charge the portable device.

CONCLUSION

The hardware for the proposed electric vehicle to grid was effectively designed and tested. For ICWPT, Adaptive Neuro Fuzzy, a novel control method, was suggested. The Neuro Fuzzy control system's performance was evaluated. It was highlighted how difficult inductive magnetic WPT in V to G is the suggested gear has a maximum wireless power transfer capacity of 70 watts. The introduction of the inverter control system affected both the transmitting and receiving sides. The WPT distance can be increased by using the variable frequency tuning option built into the transmitter part. Constant switching frequency in the receiver segment lowers the risk involved in integrating the received electricity into the grid.

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