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Wireless Charging of Electric Vehicles and Wireless Power Supply

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Abstract

Now a day, we are in situation to create pollution free environment. Per year 60% of pollution was created by vehicle Co2 emission in addition to that, the availability of petroleum product for upcoming years also create problem to our fast lifestyle. Due to lots of pollution, companies are trying to make pollution free vehicle, so they are making electrical vehicle, but again the problem comes here, they are not charged for whole time, we have to charge them again and again after a period of time, so here we are going to discuss on that.

Keywords: *Wireless Charging,* Electric Vehicles, *Wireless Power Supply*

1. Introduction

Numerous things in world are draining the layer of ozone and due to consuming of petroleum product is the fundamental driver of this. The autos utilize the most extreme number of consuming. No innovation was made that can help in non-renewable energy source decrease; thus they got ready for electrical vehicle to diminish the utilization of petroleum products and need to lessen the contamination. In any case, every single electric vehicle, similar to battery related electric vehicles and module electric vehicles are circulated barely at present attributable to some battery-related vehicles. But the problem of charging will still be there so the road way powered electrical vehicle concept was approved, with this concept when the vehicle is moving on the road the road will give supply to charge the battery of the car, that will be called as wireless power charging, so no need of waiting and charging of car. [1]

Numerous procedures have been proposed which is helping in accomplishing high effectiveness of intensity exchange. These systems, incorporates, productive pickup modules, successful pickup tuning techniques, full inverters for remote power exchange and pickup voltage control strategies. Korean online electric vehicle centre (OLEV) successfully developed roadway powered EV system which is highly efficient. Power efficiency with 60-80% at some air gap and 100-120kW output power. In Seoul Grand Park, OLEV system’s first generation was commercialized with some projects which are being executed in Korea and U.S. [1]

This paper is concentrated around streamlining for exchanging control of fragmented transmitting loops: to be specific, the ideal number of stimulated transmitting curls, comparing exchanging focuses are the key concerns, a dynamic remote power exchange framework pertinent to a stationary framework and components of remote power exchange fundamental to high power charging of uncompromising vehicles. It is likewise important to find the EV since exchanging request ought to be sent when EV lands at the exchanging focuses. The framework structure and control system in this paper are proposed on the reason that just a single EV keeps running on the level street.

The principle worry of this paper is to turn the side of the veer off control of transmitting curls. The significant errand is the ideal number of invigorated transmitting loops and the relating exchanging focuses, a dynamic remote power exchange framework material to a stationary framework and components of remote power exchange fundamental to high power charging of hard core vehicles.

AS of Now there are three types of Charging Station are available for this Electric vehicle, TYPE 1: EV charging station –120v AC Plug TYPE 2: charging Station -240v /280v AC Plug

TYPE 3: DC Fast charger

By considering the worry of electric car owners to find out suitable charging point, High cost and space consideration make us to move Type 4: wireless battery

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charger. This paper Discuss about charging station for electric vehicle with the combination of PV power and wireless battery charger.

We are now in situation to rectify drawbacks that found in wireless battery charger. Even though many advantages present in this wireless battery charger there are some Disadvantages will also present 1) charging time 2) Efficiency in performance 3) Misalignment between sender and receiver

While running on bumpy roads, the vehicle height will be affected by suspension deflection, which can be ignored while running on flat road. In segmented transmitting coil, switching control includes switching points and number of switching transmitting coil.

2. Resonators

WPT technology has been a very useful aspect for various wire diffusion because of its superconducting property which intern improves its transmission efficiency and extends the distance. In view of the above properties, WPT with high temperature superconducting (HTS) reception apparatus for EV framework, it is called as, superconducting remote power exchange for EV (SUWPT4EV) framework, which exchange control with much efficiently [2]. From a separation of 2m and a 13.56MHz power source draws out a proficiency of 40% which can rise in application, for example, restorative gadgets, purchaser hardware and transportation charging framework since there is the craving to utilize consistently revives them so as to the likelihood of sans connector gadgets [2],[6],[8],[7]. The WPT has been increasingly used in EVs than wired counter parts due to its features like fearless transmission of high power, effective charging and its overall safety [9].

The basic principle of SUWPT4EV system with inserted resonator was proposed through coupled magnetic resonance. This type of system contains RF power source (Vs), HTS Tx coil, normal conducting resonator Sx coil, normal conducting Rx coil, load and rectifying circuit [3].

In SUWPT4EV system, transmission efficiency and delivery distance of resonators were studied. All the coils were wound in helix fashion. Sx & Tx coil adopt tape type copper or HTS wire, which keep conditions and shape similar, whereas copper cable wire is been adopted by Rx. The trial setup and execution arrangements at info intensity of 400W from cases individually. Initially, it is tentatively affirmed that transmission control at Rx curl with resonators is bigger than that the without resonator under the equivalent trial conditions. Since, the resonator keeps solid reverberation coupling, the transmission separation can be extended We call attention to that this examination accomplished the first endeavor of HTS resonator in the SUWPT4EV framework so as to improve the conveyance efficiency of the electric power for EV charging strategy. Likewise, it is confirmed that the cooled cooper wire is more helpful to improve exchange proficiency than non-cooled cooper wire since its Q esteem can be improved evidently. After an extensive research, we found out that how we can efficiently charge the EV, by using HTS resonator in the SUWPT4EV system. The cooled copper wire has improved transfer efficiency to non-cooled copper wire because of it varying Q value[4].

3. Structures

Figure 1 shows the exchange of the ability to the battery of vehicle and how the vehicle will charge. It comprises of IM circuit, RF control source (Vs), copper accepting curl (Rx), HTS transmitting loop (Tx), and burden.

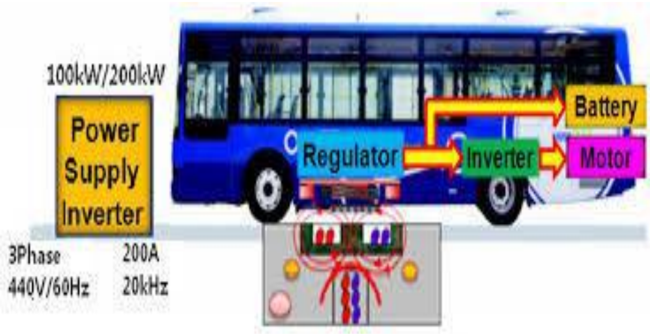

Figure 1: power exchange framework for electrical vehicle

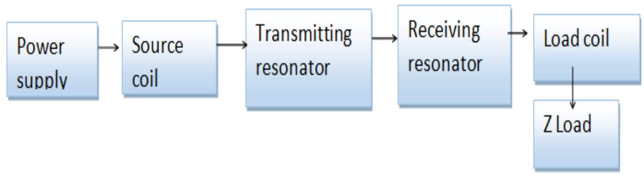

Figure 2: Block Diagram for superconductor wireless power transfer

The transmission efficiency affected by a quantity named a Quality factor (Q). Q is indirectly proportional to rate of energy loss. Strong electromagnetic coupling is a result of high Q value which in turns effects the transmission efficiency [4]. High Q Rx coil is better than high QTx. The losses which are caused in Rx coil is because of radiation and resistance and that in Tx coil is because of resistance. The proportion of each loop is being defined as Q esteem. For the most part we can characterize quality factor depends on the proportion of clear capacity to the power misfortunes in a gadget. RL arrangement circuit I framed in reception apparatus curl and Q factor can be communicated by: $Q=\frac{1}{R\sqrt{(\frac{L}{C})}}2\pi f$

4. Practical Implementation

A Wireless Power Transfer (WPT) system makes drivers free from associating with electric vehicles (EVs), thusly bringing prosperity, convenience, and adequacy to the drivers. An inductive WPT structure has been considered as a standard to the extent imaginative work [10] – [15]. To execute it, the vehicle side circle presented on an EV is required to be little in size, light in weight, and beneficial in power trade, and what's more tolerant of flat misalignment with an extensive air opening. In view of raised investigate on vehicle-side-twist setups, two possible hopefuls have turned out: One is a round or toroidal circle with donut shape windings, in which an appealing focus is filled [12] – [14]. The other is a solenoid circle with a crew focus encompassed by windings [13] – [15]. The solenoid circle is more diminutive, lighter, increasingly tolerant of misalignment in a trot and extensive air opening, and greater in non-ionizing radiation. An exceptional condition of twists has been displayed in [16] and [17], which rely upon the blend of round or solenoid circles to overhaul the misaligned execution or coupling coefficient.

Figure 3 exhibits the possibility of the proposed dynamic WPT system, in which a forced air system/dc converter unit supplies electric ability to a couple of parallel-related inverter units. An inverter unit starts task when a vehicle approaches ground-side twist unit related with the inverter. Mean control farthest point of this system is relied upon to look at further. The vehicle-side circle is mounted on the vehicle, which is ordinary to the stationary WPT twist.

The dynamic structure has diverse ground-side circles related in course of action, where each ground-side twist is the comparable as that of the stationary WPT system. No change occurs in the single vehicle-side twist with respect to bury closeness. Solenoid twists are picked in light of the way that they are preferable in misalignment execution over round circles. Another reason is that the basic inductance between the ground-side twists and the vehicle-side circle would be zero with the objective that no power continuing occurred if round circles were picked. In like manner, the H-demonstrated twists exhibited in this paper have indistinct characteristics from common solenoid circles and has cut down focus (iron) and copper incidents than the standard ones [17]. Found out results of an impedance system in the course of action related groundside twists are differentiated and the purposeful ones dependent on a practically identical transformer. The 3-kW dynamic WPT system is created and endeavored to affirm focal characteristics obliged to the course of voyaging a vehicle.

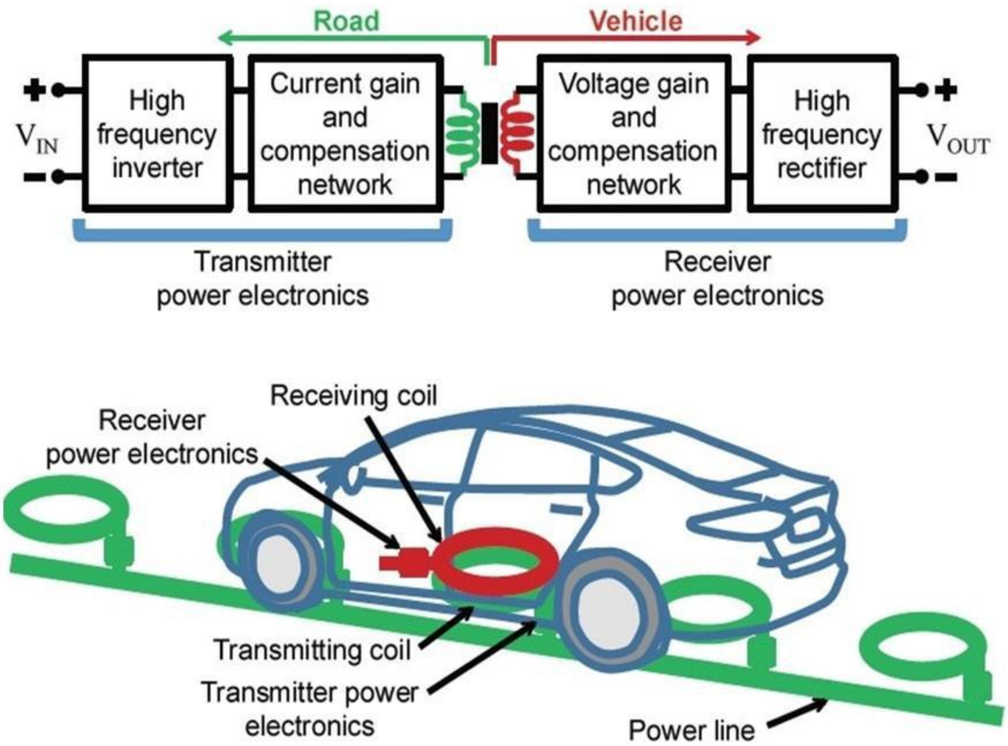

Figure 3: Idea of the proposed dynamic WPT framework

5. Stationary System

Fig. 4 shows the circuit configuration of a stationary WPT system in this experiment, which is based on the so-called “series–series” WPT system [17], [18]. An AC to DC convertor is connected with a 1φ 200V, 50Hz ac mains with a full bridge inverter of frequency 85KHz. the secondary resonating capacitor Cs and primary resonating capacitor Cp are in series with the vehicle and ground side solenoid coil. AC to Dc power conversion is achieved using a 1φ full bridge rectifier.

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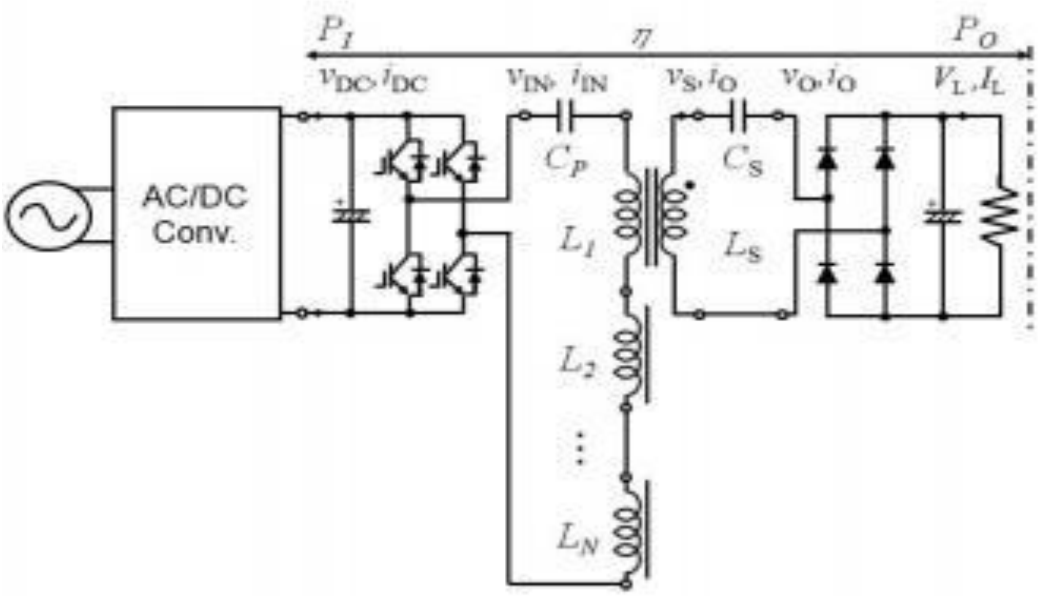

Figure 4: Circuit configuration of a stationary WPT System

The loops have an appraised limit of 3KW with an ordinary airgap of 135mm. The skin impact and the promximity impact of the winding rP and rS are much lower than the self reactance and shared reactance at the reverberation recurrence [24].

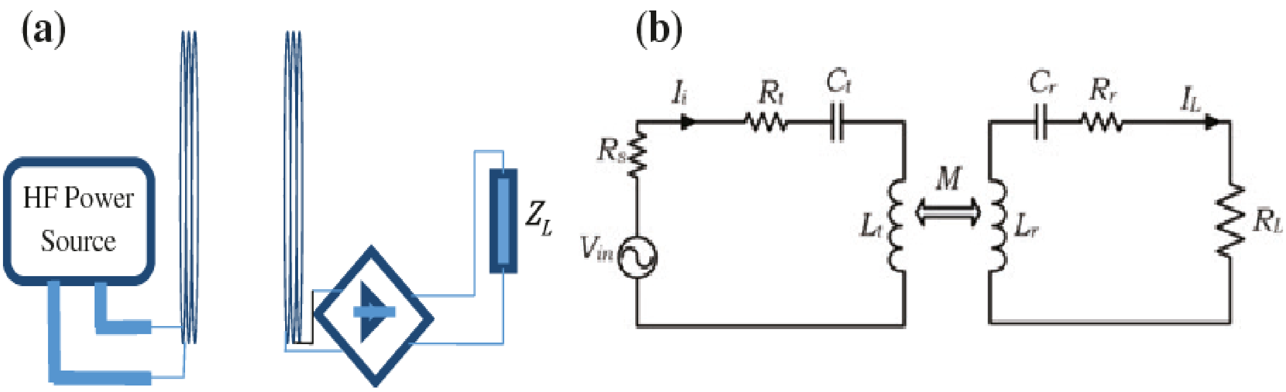

Figure 5: Equivalent circuit to the stationary WPT system

Since the winding obstruction rP and rS being an insignificant esteem are killed [22]. The information voltage is a sinusoidal voltage as Vin and precise recurrence spoke to as ω. The ground side curl LP and vehicle side loop LS are self inductances and MPS I their common inductance. The back electromotive powers (EMFs) VP and VS are given by a component of the essential and auxiliary loop flows IIN and IS as per the following:

The essential and auxiliary circuits give,

$$VP = j\omega LpIin - j\omega MpsIs \quad (1)$$

$$Vs = j\omega MpsIin - j\omega LsIs \quad (2)$$

To bring off viable power exchange, the power factor approximates solidarity in (3). Two full capacitors are resolved from the conditions. [18] [20]

$$Vin=-j\omega MpsIs \quad (3)$$

$$Vo=-j\omega MpsIin \quad (4)$$

Equations (3) and (4) represent a typical characteristic of the so-called “emittance” converter [22].

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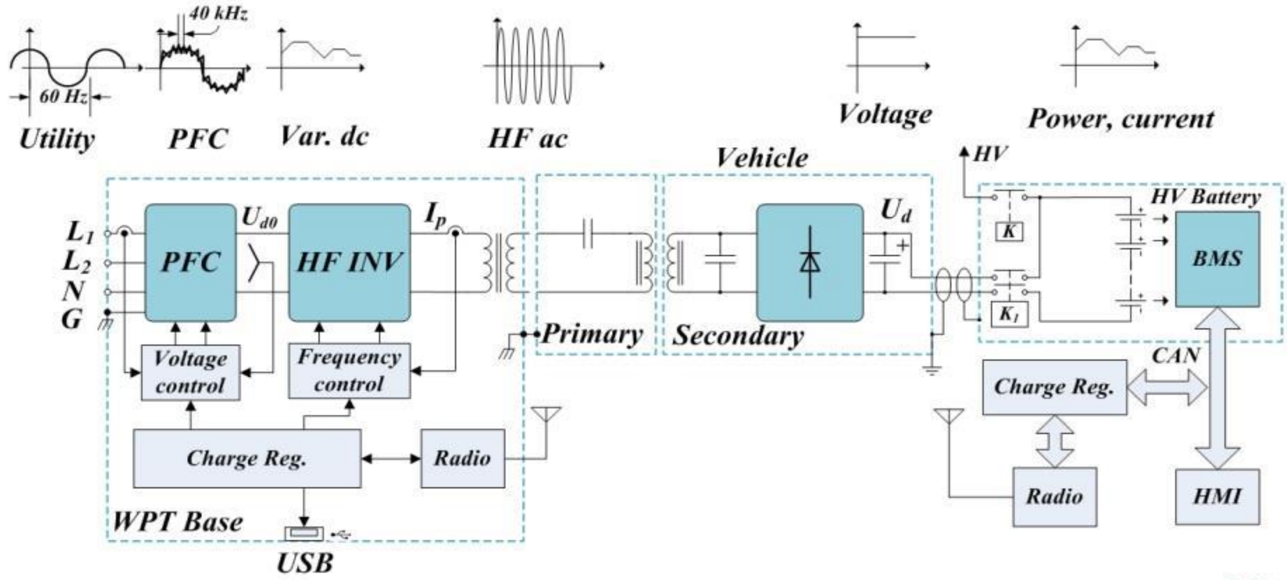

Figure 6: Practical chart of a remote charging establishment, PFC = Power Factor Corrector; BMS = Battery Management System

The working of any wireless charging system is represented atop. The top row points to the power processing stages for a unidirectional power flow from the utility grid to vehicle battery backup. Bidirectional wireless communications, charge control, sensing and regulations are shown there. The WPT has additional features i.e, user interface for updation of software maintains confidential information, guides data, provide access to archive data and vehicle to in-fracture communication [21].

The battery status sends the information like human machine interface vehicle locked for charging etc is controlled through controller area network (CAN). Comparative course of action is found in a WPT with a business board charger however a large portion of the OBC units are supplanted by charging cushion. Along these lines, the WPT share standard and accessible segments with a business OBC [22]. Different models of material science show WPT coupler as two connection conductors with a typical pivot having a greatness hole between them. This portrayal gives a few key bits of knowledge into WPT task, execution, and proficiency.

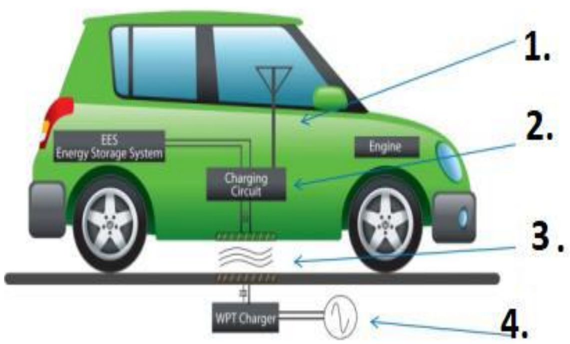

Figure 7: Frameworks of WPT

The WPT frameworks are indicated as below in points:

1. vehicle to WPT base unit interchanges (proportion) in guideline external circle.
2. Lightest, most conservative auxiliary coil, rectifier, filter and CAN/BMS interface to radio.
3. Active to open zone recorded satisfies global guidelines (ICNIRP)at 4 estimation focuses.
4. Smart network consistent utility feed and current power hardware.

Depicting about the framework right off the bat, comprises of a couple of curls in which one is the transmitter and the other is a collector. The windings are created utilizing a Litz link of reasonable transmission capacity and n number of turns. These loops are attractively coupled, but not very well because of the substantial partition [17]. Secondly, the coils are multi-turned, flat spirals with single layer structure in the form of large hooks, each having a huge surface area relative to the separation of winding [11]. Chosen coil can be of any shape or a composite one. Since, there is a routine of making secondary coil smaller than the primary, few factors like better coupling between inductances, uniform size, are important for high power and overall low cost. Thirdly, high frequency excitation given to primary turns N1 and a magnetic dipole moment M1 which supports the magnetic flux φp. the primary coil and the secondary coil are linked with little amount of leakage flux φlk.

Finally, the act of utilizing high recurrence conduits for planning a cabling and curl twisting, capacitors of low dispersal factor (DF) and delicate attractive materials situated behind each loop which bolster attractive help attractive shield layer of electrically directing materials. [10][14]. These four parts of WPT assume a noteworthy

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job in scaling to higher power levels for high effectiveness and sensible expense.

6. Conclusion

The various types of power transmission have been discussed and why WPT technology could be a deal breaker is also explained well in this paper. A practical method for implementing this WPT with its advantages and shortcomings are also discussed.

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