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Electric Vehicle Wireless Charging

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Abstract - The aim of this research is to introduce a complete fast dynamic inductive charging infrastructure from the back-office system (EV management system) up to the Electric Vehicle (EV) and the EV user (Moreover, in order to assess the impact of the additional demand of inductive charging on the grid operation, an estimation of the 24-hour power profile of dynamic inductive charging is presented considering, apart from the road traffic, the probability of the need for fast charging, as well as the specifications of the proposed solution.

Keywords — Wireless power transfer, Electric vehicle (EV) , Inductive resonance coupling, Power Transfer Module..

I. INTRODUCTION

The transmission of energy without using wires. Material and methods: Aluminum shielding is used the wireless transmission can be done by inductive coupling and resonance inductive coupling but resonance coupling is very difficult to obtain. We need to take special care when using resonant Inductive Coupling because the electromagnetic radiations might cause adverse effects on the environment.Material and methods: Aluminum shielding is used in the proposed design in order to significantly reduce the emitted EM field, and improve the coefficient of the magnetic coupling between the transmitting and receiving side.

II.ELECTRICVEHICLE

Electric vehicles when charged with a wired technology needs to be plug in routinely and it is often difficult to remember but charging through a wireless technology provides 91% efficiency through a 10% air gap and the power transfer is relatively not affected by misalignment which can be till a range of 25% misalignment and charging would be possible at work as the infrastructure expands in the future.

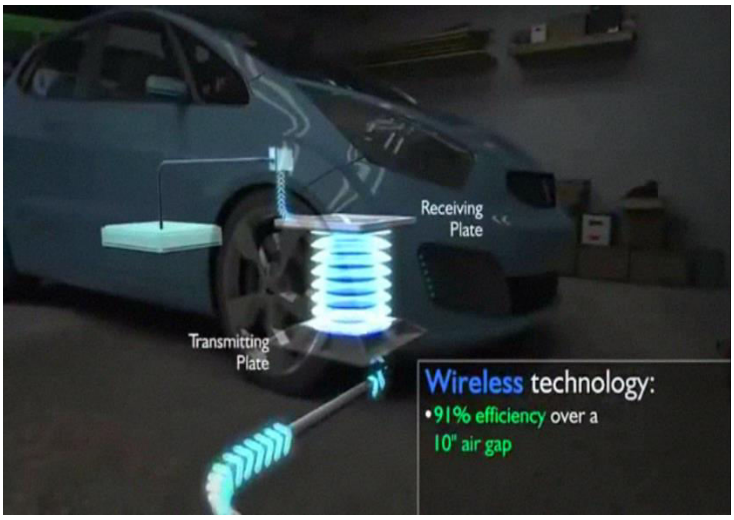

Figure 2.1 Electric Vehichle

Electric Motor

The car can run on both ac and dc supply.In case of AC motors 3 phase motors are generally used which run at 220-240 Volts AC along with 300 Volt battery packs. have the ease of availability in various sizes, shapes and power ratings in contrast to DCmotorsand also haveregenerative braking

SMPS Controller

The KA325 which is used in the circuit is a monolithic integrated circuit that includes all of the control circuits necessary for a Pulse width modulating regulator. There are a voltage referenceand error amplifier, a pulse width modulating regulator, oscillator,an under voltage lockout, a soft start circuit,and the output driver in the chip.

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Batteries

Typical batteries which are used for energy storage methods can be chemical batteries which stores the energy but better replacements in the form of LiMH batteries do exist, which not only double the range of cars but also have significantly longer lives are present, but at present are too expensive to invest in. Fuel Cells offer the most attractive solution to all these problems along with being environment friendly but still need a lot of R&D before they enter the mainstream market.

II. WIRELESS POWER TRANSFER SYSTEM FOR ELECTRICVEHICLE

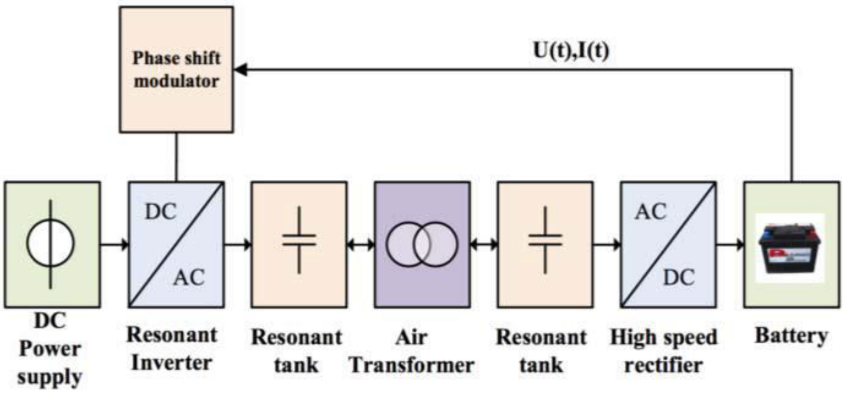

Figure 2.2 Block Diagram of WPT System for Electric Vehicle

Figure 3.1 shows block diagram of wireless power transfer system. Various components are discussed below:

Power Source

. In most power supplies the power input and output consist of electrical connectors or hardwired circuit connections though some power supplies employ wirelessenergy transfer in lieu of galvanic connections for the power input oroutput. The primary function of power source is to convert one form of electrical energy to another; as a result power supplies are sometimes referred to as electric, The power source depends on the design and gather energy from various sources of energy as some primary examples such as battery storage devices like fuel cells, electro mechanical systems such as generators or alternators ,solar power convert

PowerMosfet

Third generation Power MOSFETs from Vishay provide thedesigner with the best combination of fast switching, ruggedized device design, low on-resistance andcost-effectiveness.The TO-220AB package is universally preferred for all commercial-industrial applications at power dissipationlevels to approximately 50 W. The low thermal resistance and low package cost of the TO-220AB contribute to itswide acceptance throughout the industry**.**

Driving Circuit

A typical digital logic output pin can provide a supply tens of MA of current. Larger devices might even need several amps.. A 3 ampere transformer is coupled to a 6 a bridge rectifier which is connected to a 1000mf 50v capacitor which is further joined by a power led (red)which is connected to a 7809 bridge rectifier on the transmitting side and on receiving side consists 20 turns winding connected to the bridge rectifier and 10mf capacitorwhich is connected to a 220 v resistor through a led which is coupled to the car motor.In battery operated devices the load may be directly connected to the battery power and it does not pass through a voltage regulator. Many devices such as motors have a momentary large inrush current spike when they are first turned on and have a larger stall current so be a bit conservative on the maximum currentratings.

Battery Charger

A battery charger, or recharger, is a device used to put energy into a secondary cell or rechargeable battery by forcing an electriccurrent through it.. Some battery types have high tolerance for overcharging and can be recharged by connection to a constant voltage source or constant current source simple chargers of this type required disconnection manually or else . Other battery types cannot withstand long high-rate over-charging the charger may there must be present a timer action to cut off the charging current at specific time and the other batteries must have temperature or voltage sensing circuits and a microprocessor controller to adjust the charging current determine the state of charge and cut off at the end of charge.

Battery

An electric battery is a device consisting of two or more electrochemical cells that convert stored chemical energy into electrical energy. Each cell has a positive terminal or cathode and a negative terminal or anode. The terminal marked positive is at a higher electrical potential energy than is the terminal marked negative. The terminal marked positive is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device.

LED

A led is a light emitting diode it’s a semiconductor device which emits light when an electric current is passed through it.

Inside the material of semiconductor of led there are electrons and holes contained within the energy band. The semiconductor materials may be made of III-V materials as such as gallium arsenic (GaAS) gallium phosphide (Gap). Until mid 90ss it had limited range of colors but in particular white and commercial blue does not exist.as we all know that electroluminescence as a phenomenon was discovered by sir H.J round of Marconi labs in the year 1907 using a crystal of silicon carbide and a cat whisker’s detector.

And as the year passed on later 1n 1936 Georges Destriauobserved that when sulphide of zinc powder is suspended in an insulator, electro-luminance could be produced. The active region which consists more than one lnGaN quantum wells which is sandwiched betweenGaN thicker layers. those layers are called the cladding layers.By varying the relative ln/Ga fraction in the quantum wells, it can be varied from violet to amber.for safety and health we must consider certain blue leds and cool white LEDs can create a so called blue – light hazard when it exceeds safe limits.

III. RESONANT INDUCTIVE COUPLING

Primary and secondary coils are not connected with wires .Energy transfer is due to Mutual Induction Transformer is also an example Energy transfer devices are usually air-cored Wireless Charging Pad (WCP), electric brushes are some examples.The concept behind resonant inductive coupling is that high Q factor resonators exchange energy at a much higher rate than they lose energy due to internal damping.. This is called "mid-range" transfer in contrast to the "short range" of non-resonant inductive transfer which can achieve similar efficiencies only when the coils are adjacent. The drawback can be explained when at a close range the coupling is not constant and it is been slit into 2 peaks and the maximum power transfer does not take place as a case of consideration it must be tuned to a resonance peak.

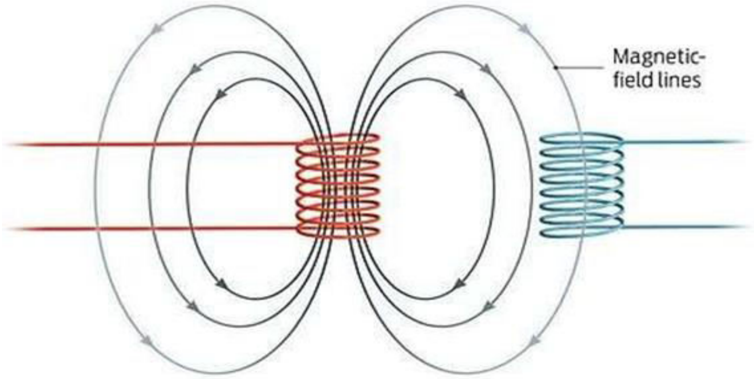

Figure 3.1 Resonant inductive wireless power systems

In modern inductive wireless power systems resonant technology is currently being used of one such possibility exists for this methodis in the area of coverage for wireless power .this method could be very beneficial in the reduction of 6 billion batteries disposed of each year, a large source of toxic waste and ground water contamination

V.IPT Module

The proposed dynamic inductive charging station, which is presented in, comprises four successively placed primary coils. The powerelectronics topology consists of a common IGBT module and four IGBT modules, each one connected to one of the four primary coils .The common IGBT module is continuously enabled given that the charging station is in operation. Concerning the other four modules, they are enabled successively such that only one module operateeachtimeformingafullbridgeconverterwiththecommon module.

In order to ensure the activation of one primary coil at a time, magnetic sensors are placed before each primary coil which are activated as the EV passes over them. In order to reduce the voltage applied in the primary coils and assure their galvanic isolation, the converter is connected to each one of the charging coils with a set of two parallel connected transformers TR3||TR4… TR9||TR10. Moreover, a series-series compensation scheme is applied to the design CS3-CS4…CS9-CS10 for each one of the four primary coils.The frequency shift control method is adopted in the inverter allowing the control of the output parameters of the IPTM (voltage, current and power supplied to the battery) according to the air-gap and misalignment between the primary and the secondary coil. In order to efficiently allow greater variations in the high frequency voltage supplied by the converter, the phase shift PWM technique is also incorporated in the designFast dynamic inductive chargingapproach. Power electronics topology of the inductive charging station.The IPT module is illustrated in. Ferrite is adopted in the coil design in order to enhance and guide the magnetic flux. More specifically, Mn-Zn ferrite plates are implemented due to their relatively high permeability, their excellent mechanical and electrical properties and the fact that they can be easily combined into many possible shape

I. COUPLINGCOILS

Aluminum shielding is used in the proposed design in order to significantly reduce the emitted EM field, and improve the coefficient of the magnetic coupling between the transmitting and receiving side. In case of a horizontal misalignment between the primary and secondary coil, an asymmetric leakage of electromagnetic radiation can be observed Although the leakage close to the primary coil does not indicate any threat to objects or humans nearby, since the coil is buried underground, the leaked radiation close to the secondary coil could negatively affect nearby objects. Such results indicate that all elements close to the secondary winding, including the positioning mechanism, shall comprise nonmagnetic materials. Based on simulations results examining various coil dimensions, it is concluded that when the horizontal misalignment is greater than one quarter of the winding size, the coupling coefficient, as well as the efficiency of the whole system significantly decreases. Furthermore, the maximum efficiency is inversely proportional to the air-gap; therefore, the operational air-gap of the IPT system must be selected very carefully. In this respect and in order for the IPTM to transfer a power of 30 kW at a horizontal misalignment of ± 20 cm and an air-gap of 80±10mm. one way of increasing the coupling is that the use of ferrite in the coils which is a ferromagnetic material and the magnetic flux can be increased .. Coupling may be intentional or unintentional. Unintentional inductive coupling can cause signals from one circuit to be induced into a nearby circuit, this is called cross-talk and is a form of electromagneticinterference.

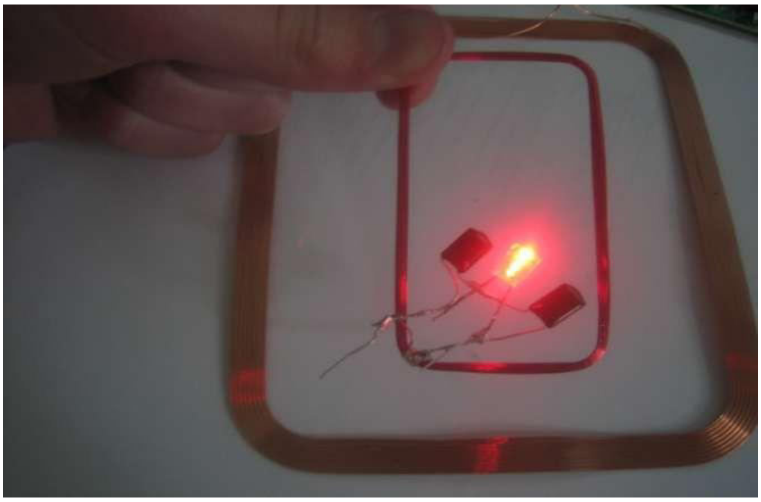

Figure 4.1 Picture of coupling coil

The power can be mechanically transferred without making contact as in the magnetic gear.

Anaircorecoppercoilismostlyusedtofor making inductive coupling coil circuit. The inductance of an air core inductor is calculated by below formula,

$$L = (d^2 * n^2) / (18d+40l) \qquad \text{………. (1)}$$

Where: L is inductance in micro Henrys
d is coil diameter in inches
l is coil length in inches
n is number of turns

The both coils are similar in construction as shown in figure4.1. Both the coil that is transmitting and receiving coils should similar mutual inductance between them which will be

$$M = \sqrt{L1L2} = L \qquad \text{……….. (2)}$$

And coupling coefficient should be

$$k = M/\sqrt{L1L2} \qquad \text{………. (3)}$$

II. MODELDEVELOPED

Wireless power transfer system is developed by using copper wire of inductance value 57 µH of both transmitting and receiving coil. The 8V battery is used for the electric vehicle i.e that is battery powered vehicle.The Fig shows picture of actual hardware model. Wind TX/RX CoilsUsing a SWG or SWG copper wire with a Centre tap at
20 turn.There are total 40 turns used in the following circuit as mentioned below

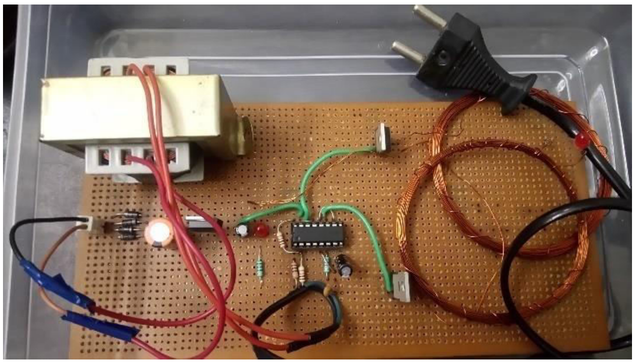

Figure 5.1 Picture of actual hardware model

Principle of strong inductive coupling is used for efficient transfer of power. A 6A Bridge rectifier and 1000mf capacitor are used to filter rectify and purify received power. An LCD is used to display charging and not charging condition of vehicle. Press button is used operation of vehicle.

CONCLUSION

Focusing on electric vehicle inductive battery chargers, on can see that several requirements have to be met. Battery charge modes, robustness of control and electromagnetic compliance are the most important ones but when considering economic aspects, simplicity and reliability become important to Furthermore, if inter-operability, or standardization, may be reached, chances for ICPT systems being quickly spread in industry,private transportation vehicles are real.

REFERENCES

1.Carlson, R. and Normann, B., "Test Results of the PLUGLESS™ Inductive Charging System from Evatran Group, Inc.," *SAE Int. J. Alt. Power.* 3(1):64-71, 2014, doi:10.4271/2014-01-1824.

2. Chwei-Sen Wang, Stielau, O.H., and Covic, G.A.: 'Design considerations for a contactless electric vehicle battery charger', IEEE Trans. on Ind. Electronics, Volume: 52, Issue: 5, pp. 1308 - 1314, 2005, doi: 10.1109/TIE.2005.855672

3. Nagatsuka, Y., Ehara, N., Kaneko, Y., Abe, S., et al.: 'Compact contactless power transfer system for electric vehicles', International Power Electronics Conference (IPEC), 2010, pp. 807-813, doi: 10.1109/IPEC.2010.5543313

4. Chigira, M., Nagatsuka, Y., Kaneko, Y., Abe, S., et al.: 'Small-Size Light-Weight Transformer with New Core Structure for Contactless Electric Vehicle Power Transfer System', Energy Conversion Congress and Exposition (ECCE), 2011, pp. 260-266, doi: 10.1109/ECCE.2011.6063778

5. Covic, G.A., and Boys, J.T.: 'Modern Trends in Inductive Power Transfer for Transportation Applications', Emerging and Selected Topics in Power Electronics, IEEE Journal of, Volume: 1, Issue: 1, 2013, pp. 28 - 41, doi: 10.1109/JESTPE.2013.2264473

6. Mecke R. and Rathge C., "High frequency resonant inverter for contactless energy transmission over large air gap," in Power Electronics Specialists Conference, 2004. PESC 04. 2004 IEEE 35th Annual, 2004, pp. 1737-1743 Vol.3, doi: 10.1109/PESC.2004.1355378

7. Budhia, M., Covic, G.A, and Boys, J.T: 'Design and optimization of magnetic structures for lumped inductive power transfer systems' IEEE 10.1109/TPEL.2011.214373