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REVIEW ON DYNAMIC WIRELESS EV CHARGING

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Abstract-: Dynamic Wireless Charging of Electric Vehicle approach revolutionizes the changes in Electric Vehicle Industry. Existing Electric Vehicle Batteries are designed to power the Drive for minimum hundred kilometers range. Beyond hundred kilometers range the Battery capacity must be increased which in turn increases the cost of electric vehicle and charging time. With Dynamic Wireless Charging the Battery size can be reduced for same travel range, Thereby reducing the cost of electric vehicle and charging time.

The Present work deals with the Development and Simulation of Dynamic Wireless Charging of Electric Vehicle (i.e. charging in motion). Dynamic Wireless Charging of Electric Vehicle system contains road embedded number of inductive coils. Selection of number of inductive coils depends on the track length. Each inductive coil acts as a Transmitter, for wireless power transfer the transmitter coil terminals are excited by high frequency resonant inverter. Solar panel along with Boost converter supplies dc power to resonant inverter which in turn converts dc input to high frequency AC output. Wireless charging using resonant inductive power transfer utilizes high frequency magnetic field to transfer power from primary to secondary over a large air gap. Receiver Coil is placed on Chassis of Electric Vehicle and connected to on board rectifier circuit. Rectifier with capacitor filter converts the bidirectional signal to unidirectional signal and provides regulated dc output.

I INTRODUCTION

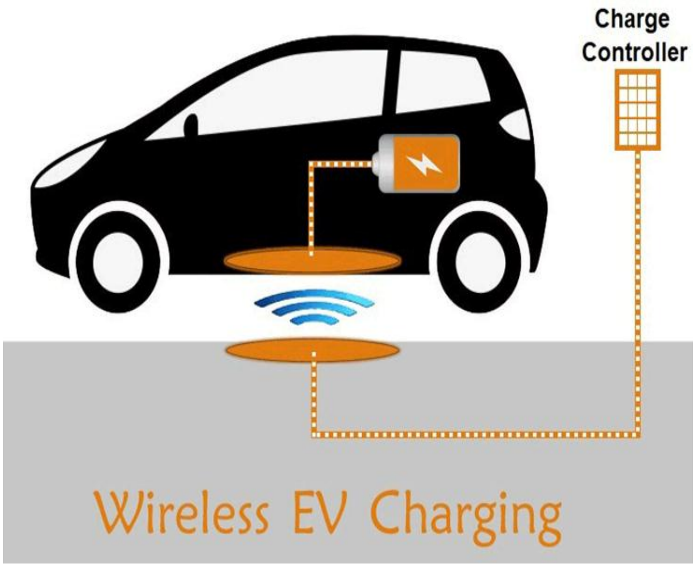
Wireless dynamic charging of Electric Vehicles (EV) is a key technology in reducing our global dependence on fossil fuels and allows greatly increased operating range without the added expense and weight of a larger battery pack. Inductive Power Transfer is the most promising technique to achieve this goal, offering advantages such as higher performance, safety through electrical isolation, and resistance to contamination. A typical dynamic charging system consists of roadway mounted coils, referred to as primary pads, which are magnetically coupled to secondary pads mounted on the underside of a dynamic charging equipped EV. As the EV moves over each primary pad, energy is transferred to the EV through the secondary pad and the power processing circuit. The primary pad array must be energized selectively in sections that are smaller than the overall dimensions of the vehicles travelling over them. It has also been demonstrated that discrete pads are more economically feasible than a single continuous track due to civil engineering constraints.

II PROPOSED SYSTEM

Now a days world is shifting towards electrified mobility to reduce the pollutant emissions caused by nonrenewable fossil fueled vehicles and to provide the alternative to pricey fuel for transportation. But for electric vehicles, traveling range and charging process are the two major issues affecting it's adoption over conventional vehicles.

With the introduction of Wire charging technology, no more waiting at charging stations for hours, now get your vehicle charged by just parking it on parking spot or by parking at your garage or even while driving you can charge your electric vehicle. As of now, we are very much familiar with wireless transmission of data, audio and video signals so why can't we transfer power over the Air.

Basic principle of wireless charging is same as transformer working principle. In wireless charging there are transmitter and receiver, 220V 50Hz AC supply is converted into High frequency alternating current and this high frequency AC is supplied to transmitter coil, then it creates alternating magnetic field that cuts the receiver coil and causes the production of AC power output in receiver coil. But the important thing for efficient wireless charging is to maintain the resonance frequency between transmitter and receiver. To maintain the resonant frequencies, compensation networks are added at both sides. Then finally, this AC power at receiver side rectified to DC and fed to the battery through Battery Management System (BMS)



Types of EVWCS

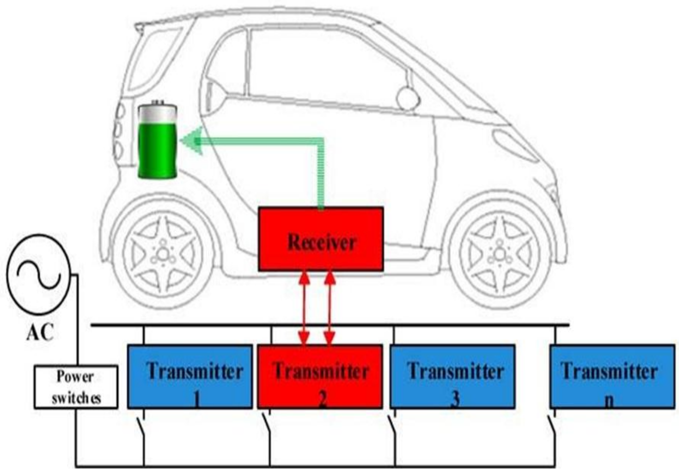
Based on operating Techniques EVWCS can be classified into four types

1. Capacitive Wireless Charging System (CWCS)
2. Permanent Magnetic Gear Wireless Charging System (PMWC)
3. Inductive Wireless Charging System (IWC)
4. Resonant Inductive Wireless Charging System (RIWC)

We are using Resonant Inductive Wireless Charging System

Resonant Inductive Wireless Charging System (RIWC)

Basically resonators having high Quality factor transmit energy at much higher rate, so by operating at resonance, even with weaker magnetic fields we can transmit the same amount of power as in IWC. The power can be transferred to long distances without wires. Max transfer of power over the air happens when the transmitter and receiver coils are tuned i.e., both coils resonant frequencies should be matched. So to get good resonant frequencies, additional compensation networks in the series and parallel combinations are added to the transmitter and receiver coils. This additional compensation networks along with improvement in resonant frequency also reduces the additional losses. Operating frequency of RIWC is between 10 to 150 KHz.



Wireless Electric Vehicle Charging Standards

Wireless charging makes EV to charge without any need of plug in. If every company makes its own standards for wireless charging systems that won't compatible with other systems then it won't be a good thing. So to make wireless EV charging more user friendly Many international organizations like International Electro Technical Commission (IEC), the Society of Automotive Engineers (SAE), Underwriters Laboratories (UL) Institute of Electrical and Electronics Engineers (IEEE) are working on standards.

- SAE J2954 defines WPT for Light-Duty Plug-In EVs and Alignment Methodology. According to this standard, level 1 offers maximum input power of 3.7 Kw, level2 offers 7.7Kw, level 3 offers 11Kw and level4 offers 22Kw. And the minimum target efficiency must be greater than 85% when aligned. Allowable ground clearance should be up to 10 inches and side to side tolerance is upto 4 inches. The most preferable alignment method is magnetic triangulation that assists to stay within charge range in manual parking and assists to find parking spots for autonomous vehicles.
- SAE J1772 standard defines EV/PHEV Conductive Charge Coupler.
- SAE J2847/6 standard defines Communication between Wireless Charged Vehicles and Wireless EV Chargers.
- SAE J1773 standard defines EV Inductively Coupled Charging.
- SAE J2836/6 standard defines Use Cases for Wireless Charging Communication for PEV.
- UL subject 2750 defines Outline of Investigation, for WEVCS.
- IEC 61980-1 Cor.1 Ed.1.0 defines EV WPT Systems General Requirements.
- IEC 62827-2 Ed.1.0 defines WPT-Management: Multiple Device Control Management.
- IEC 63028 Ed.1.0 defines WPT-Air Fuel Alliance Resonant Baseline System Specification

III ADVANTAGES & APPLICATION

Advantages:-

The advantages of our project are as mentioned below.

- More Convenient.
- No manual recharging or changing batteries.
- More Reliable.
- Never run out of battery power.
- More Environment Friendly.
- Reduce use of disposable batteries.

Application:-

- Some of the applications are as mentioned below.
- Wireless charging of dynamic electric vehicles.
- Wireless charging of any dynamic electronic device

IV CONCLUSION

Dynamic Wireless Charging of Electric Vehicle approach revolutionizes the changes in Electric Vehicle Industry. Dynamic Wireless Charging of Electric Vehicle reduces the cost and size of the battery, thereby reducing the cost of electric vehicle. Simulation of Dynamic wireless charging system with transmitter and receiver coils at an air gap of 27cm at 23KHZ frequency with K=0.9 coefficient of coupling and efficiency of 93.4% have been achieved. Simulink models High frequency 23 kHz resonant inverter and solar panel with Boost converter are developed at transmitter end. Simulink models of rectifier with filter and traction motor have been developed at receiver coil end. Simulation results of state of charge (SOC) of electric vehicle battery at different alignment and mis-alignment positions of coils have been achieved. The Electric vehicle batteries which use to take 2-3hrs to charge up to the rated value will be charged with in 40min as their battery capacity is reduced. With reduced new battery capacity using dynamic wireless charging system electric vehicles can be charged under motion.

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