DIFFERENT TYPES OF WIRELESS ELECTRIC VEHICLE CHARGING METHODS

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ABSTRACT: Day by day pollution is increasing which is affecting the Ozone layer. One of the reasons which affects the Ozone layer is CO2 released by diesel and petrol vehicles. To overcome this affect we are moving towards Electrical vehicles (EV) which consists Battery. So, we need to charge the battery by Electrical vehicle charging station. They are two types of charging station wired and wireless. This Paper is about different types of wireless charging methods. Wireless charging means power transfer technology when the vehicle is moving on a road or parking on the road it automatically charge the battery based on the principle of magnetic field-based system. The receiver is attached to the vehicle it receives the energy from the transmitter.

Keywords: Electric vehicle 1, Inductive power transfer technology (IPT) 2, Magnetic field-based system 3, Receiver 4, Transmitter 5

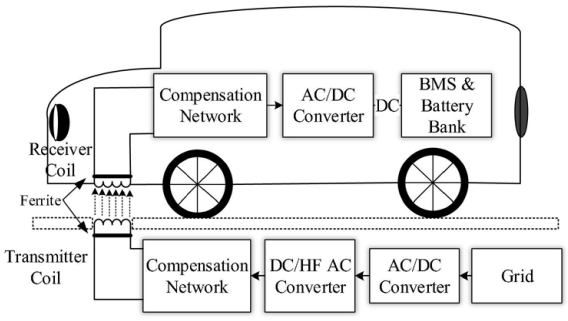

Fig:1 Structure of wireless charging of EV

INTRODUCTION:

This paper discusses about "ELECTRIC VEHICLE CHARGING STATION" provides a unique method of charging electric vehicle easily. Now a days world is shifting towards electrified mobility to reduce the pollutant emissions caused by non-renewable fossil fuel 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 its 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.

Thanks to great scientist Nikola Tesla for his limitless amazing inventions in which wireless power transfer is one of them. He started his experiment on wireless power

transmission in 1891 and developed Tesla coil. In 1901 with the primary goal to develop a new wireless power transmission system Tesla started developing the Wardenclyffe Tower for large high-voltage wireless energy transmission station. The saddest part is to satisfy Tesla's debts, the tower was dynamited and demolished for scrap on July 4th 1917.

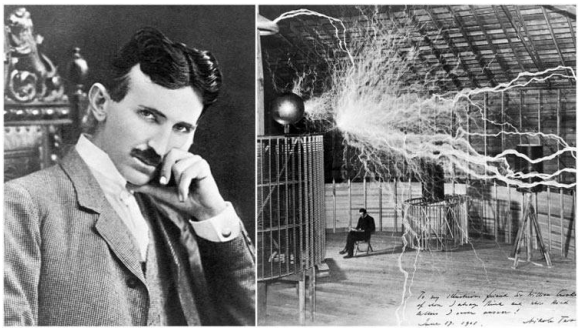

Fig:2 Nikola Tesla

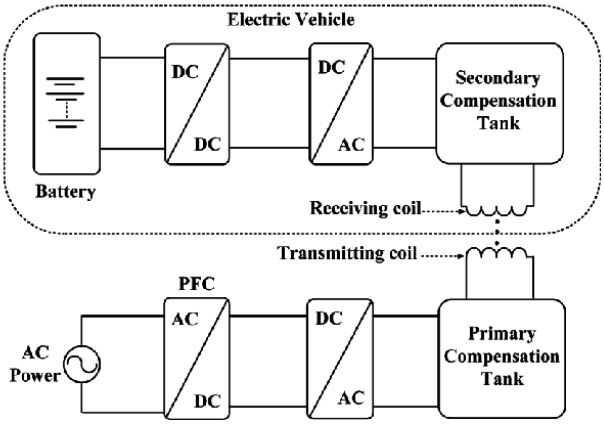

Fig.3 Block diagram of wireless charging electric vehicle

Basic principle:

Basic princple 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 WIRELESS CHARGING STATIONS:

Wireless charging systems for electric vehicles can be divided into two categories according to their application areas:

- Static Wireless Charging
- Dynamic Wireless Charging

1. Static Wireless Charging:

As the name suggests, the car will charge when it is parked. Here, we can simply park the electric car in a parking lot or garage equipped with WCS. The transmitter is installed underground, and the receiver is installed at the bottom of the vehicle. Charge the car, customize the transmitter and receiver, and then charge. The charging time depends on the power level of the AC power source, the distance between the transmitter and receiver, and the size of the contact area. This SWCS is best constructed in a location where the electric vehicle is parked for a period of time.

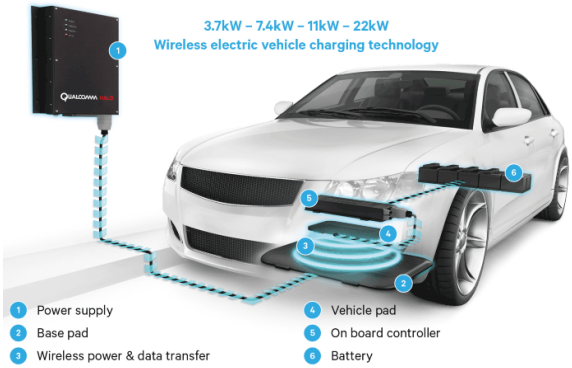

Fig:4 Static wireless charging

2. Dynamic Wireless Charging System (DWCS):

As the name implies, the vehicle will charge while it is driving. The energy is transmitted through the air from the stationary transmitter to the receiving coil of the moving vehicle. With DWCS EV, you can continuously charge the battery while driving on roads and highways, thereby extending the driving range. This reduces the need for large energy storage, which further reduces the weight of the vehicle.

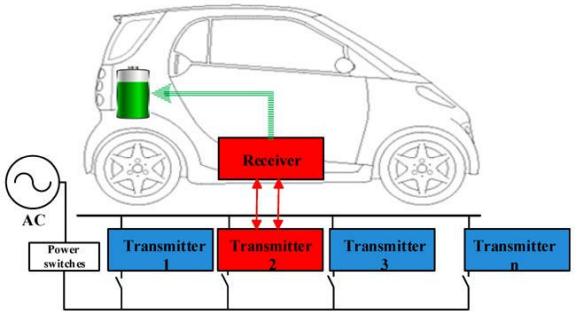

Fig:5 Schematic diagram of dynamic wireless charging

Types of Electric Vehicles Wireless Charging Systems

Based on operating Techniques EVWCS can be classified into four types

- Capacitive Wireless Charging System (CWCS)
- Permanent Magnetic Gear Wireless Charging System (PMWC)
- Resonant Inductive Wireless Charging System (RIWC)
- Inductive Wireless Charging System (IWC)

1. Capacitive Wireless Charging System (CWCS):

The wireless energy transmission between the transmitter and the receiver is achieved by using the bias current caused by the change in the electric field. Instead of magnets or coils, coupling capacitors are used as transmitters and receivers to transmit power wirelessly.

Power factor correction circuit can improve efficiency and maintain voltage level and reduce power transmission loss. It is then fed to the H bridge to generate a high-frequency AC voltage, and this high-frequency AC current is applied to the drive board to generate an oscillating electric field, which generates a bias current at the board receiver through electrostatic induction.

The receiver voltage on the receiver side is converted into direct current to provide a rectifier and filter circuit for the battery through the BMS.

Frequency, voltage, the size of the blocking capacitor, and the air gap between the transmitter and receiver will affect the energy emitted. The operating frequency range is 100 to 600 kHz.

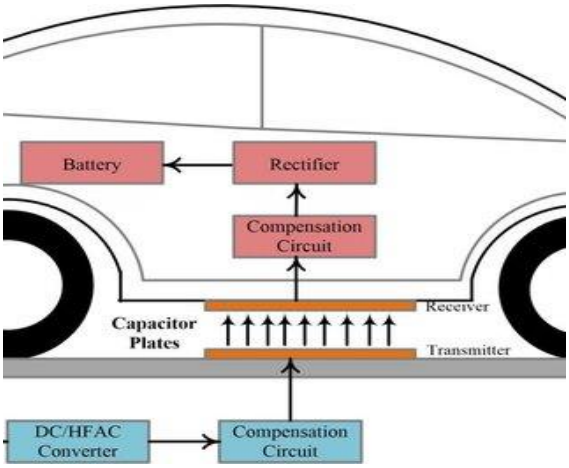

Fig:6 Schematic diagram of capacitive wireless charging

2. Permanent Magnet Gear Wireless Charging System (PMWC):

Here, the transmitter and receiver are composed of armature windings and synchronous permanent magnets in the windings. Viewed from the side of the

launcher, its operation is similar to that of an engine.

When we apply alternating current to the transmitter coil, a mechanical torque is generated. Place it on the magnet of the transmitter and make it rotate. By changing the magnetic interaction in the transmitter, the PM magnetic field induces a torque in the PM receiver, causing it to rotate synchronously with the transmitter magnet.

The change in the constant magnetic field of the receiver now results in the formation of alternating current in the windings, ie the receiver acts as a generator because the mechanical power provided by the receiver to the PMT is converted into electrical energy.

The connection of rotating permanent magnets is called magnetic transmission. The alternating current generated on the receiver side is rectified and filtered by the rectifier to power the battery.

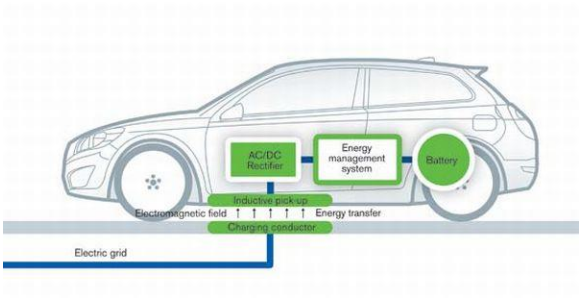

Fig:7 Permanent magnet gear wireless charging

3. Resonant Inductive Wireless Charging System (RIWC):

Basically, high-Q resonators transfer energy at a faster rate. Therefore, if we can also resonate in a weaker magnetic field, then we can deliver the same amount of energy as IWC. Energy can be transmitted over long distances without cables. When the transmitter and receiver coils are matched, energy is generated in the air. H. The resonant frequencies of the two coils must match.

Therefore, in order to obtain a good resonance frequency, additional compensation circuits are added to the transmitter and receiver coils in a combination of series and parallel. The additional compensation circuit and the improved resonance frequency reduce the additional loss. The operating frequency of RIWC is 10 to 150 kHz.

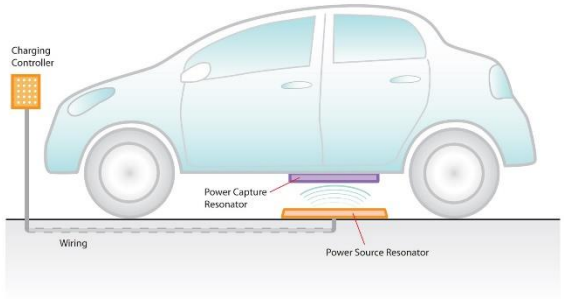

Fig:8 Diagram of resonant inductive wireless charging

4. Inductive Wireless Charging System (IWC):

The basic principle of IWC is Faraday's law of induction. Wireless energy transmission is achieved by mutual induction of magnetic fields between the transmitter coil and the receiver coil.

When the main AC power is applied to the transmitter's coil, it will generate an AC magnetic field flowing through the receiver. The coil and this magnetic field move the electrons in the receiving coil and produce AC output.

The AC output is rectified and filtered to charge the energy storage system of the vehicle. The transmitted energy depends on the frequency, mutual inductance, and the distance between the transmitter and receiver coils. The IWC frequency is 19 to 50 kHz.

Fig:9 Development of inductive charging on roads

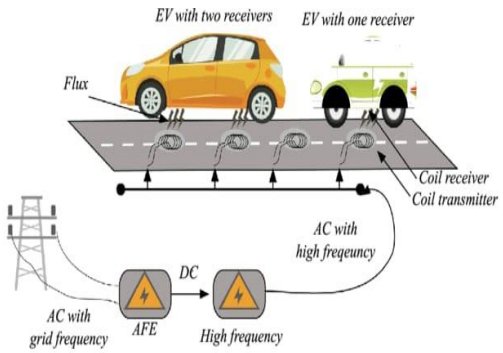

Fig:10 Schematic diagram of inductive wireless charging

Battery:

Engine is the heart of the vehicles but in similarly batteries are the one of most important thing to run electrical vehicles. Most of the vehicles used by "LITHIUM-ION" batteries to run the vehicles.

Electric Vehicle Battery Specification:

To buy electric vehicle batteries, you need to understand the upcoming modifications of automotive lithium-ion batteries. You need to know the specifications of the battery. These features vary from manufacturer to manufacturer and can be very complex.

But you don't need to learn chemistry, lithium-ion batteries for cars. They have simple mechanical and electrical properties that you can use. These components create the entire system to help the park perform.

Here are some basic elements that make these batteries different. Lithium-ion batteries for cars.

Their chemical reactions are lithium-ion batteries for automobiles. The most important component of this battery is the discrete battery. Batteries are interconnected in series and parallel. This enables them to provide the necessary voltage and current to power the battery pack. There may be hundreds of separate cells in a park. Lithium ion battery for modular automobile. The manufacture and assembly of electric vehicle batteries are not easy. In order to reduce stress, it will be great. The battery cells are further grouped into modules. Some modules can also be put together to make a package. The batteries in the module are then bonded to each other by welding. This completes the current flow, so that every part of the car can get power as needed.

Battery management system lithium-ion battery for automobile. Sometimes the battery produces too little or too much power. To ensure that this will never happen, these modules allow the voltage to be monitored through the BMS. Fuse lithium-ion battery for automobile. We all know the function of fuses. It has the same function here to limit the current in case of short circuit. Contactor

lithium ion battery for automobile. There is also a contactor inside the battery pack. They ensure the correct distribution of power to the output terminals.

A variety of temperature, voltage and current sensors, lithium-ion batteries for automobiles. These components are responsible for collecting data and sending it to relevant areas.

Bev batteries need to be recharged from time to time. Lithium-ion batteries for cars. Like an ordinary car running out of gas, they run out of electricity. A strong battery takes longer than a weak battery.

Advantages of wireless charging of electric vehicles

- The ability to recharge an electric vehicle wirelessly has various advantages over traditional cable charging techniques.
- The lack of something like a charging cable is the first big advantage, and any engineer who has worked on cable and connection designs knows how problematic these can be. To begin with, connections can deteriorate with time, limiting their capacity to function effectively.
- Second, cables must be selected to handle the necessary power rating; however, if the power rating changes inside the future, the connection may no longer be acceptable.
- The necessity for a common connection that all manufactures can agree on is the next challenge with employing a charging cord.
- More functions may be required of the charging cable as technology advances, and such modifications may not be practical, restricting the cable's potential.
- In parking areas and garages in which the EV will remain stationary, a wireless charging device can be added. The EV may then charge when it is not in use, extending its range and making it more practical.
- Wireless charging stations on roadways, if developed further, might charge electric vehicles while driving or during extended traffic jams.

Disadvantages of wireless charging of electric vehicles:

1.Wireless chargers can have efficiency as low as 60 %, whereas charging connections can transfer nearly 100% of energy from the generator to the battery.

2.Given that fossil fuels account for a substantial amount of energy generation, this inefficiency would result in an increase in CO2 emissions.

3.The distance between both the car and the charging station exacerbates the efficiency issue using wireless chargers.

4.Whenever the distance between any two coils is as near to each other as feasible, wireless chargers are also most efficient.

5.However, there would be a big difference between a recharging pad on just the floor with one on the vehicle's base.

6.While a portable charger in a car park or garage is possible, it is unclear that it would ever function on major highways.

7.Instead of being lifted, a such charger would have to be installed into the road; otherwise, it would act as a speed bump.

8.Wireless chargers, as a primitive transformer, are also reliant on the number of turns in each coil.

9.As a result, all makers would have had to adhere to a set of coil sizes, turns, and power ratings, which is the same problem that existing charging cable makers face.

Conclusion:

Wireless charging is a natural step in the evolution of electric vehicles. It is a very convenient and efficient way of charging the battery and can be installed at home, on the road, or in other places where electric vehicles come to rest.

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