Resincap Journal of Science and Engineering
Volume 3, Issue 5 May 2019
ISSN: 2456-9976

Wireless Charging of Electric Vehicle by Solar Energy

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ABSTRACT

Burning of fossil fuel is one of the major reasons for polluting the environment. This pollution and depletion of fossil fuel has opened up the market of electric vehicles and an emergence of use of renewable sources of energy. In electric vehicles, plug-in based charging method has major drawbacks such as charging a vehicle at a time, less reliability and spatial issues. To avoid these problems and to increase reliability we proposed a system for charging station. In this a user will know charging price for particular period of time, charge in battery (level), and predicts the life of battery or at what distance the battery will with particular level. This also shows no. of charging stations on map..

Keywords

Renewable energy, EV, Wireless Charging

1. INTRODUCTION

The concern over the environment due to the greenhouse gases emitted by the conventional internal combustion engine (ICE) vehicles is the major factor that accelerates the growth of the electric vehicle (EV) industry at a sustainable level. On the other hand, the prospect of the EV has initiated the integration of the electrical power and the transportation systems in a way that has not been conceivable before. The main link between the two sectors is the charging of the batteries. Charging stations fall into four basic contexts:

1.1 Residential Charging Stations

The EV users plug in when they return home, and their car recharges overnight. A home charging station usually has no user authentication, no metering, and may require wiring a dedicated circuit. Some portable chargers can be wall mounted as a charging station.

1.2 Charging While Park

A commercial venture, offered in partnership with the owners of the parking lot. This charging may be slow or higher speed, and encourages EV users to recharge their car while they take advantage of nearby facilities. It can include parking stations, parking at malls and small centers.

1.3 Charging at Public Charging Stations

These chargers may be at rest stops to allow for longer distance trips. They may also be used regularly by commuters in metropolitan areas, and for charging while parked for short or longer periods.

1.4 Battery Swaps or Charging in Less than 15 Minutes

It is achievable with EV battery swaps and Hydrogen Fuel Cell vehicles. It intends to match the refueling expectations of regular drivers. This had been possible due to the reasons that battery capacity and the capability of handling faster charging are both increasing.

1.5 Motivation

- Global Warming/Climate Change: due to release of carbon dioxide by burning of fossil fuels.
- Rising Prizes: Due to depletion of the reserves of Oil and Natural Gas.
- Acid Rain: Due to Sulphur Dioxide released by burning of fossil fuels.
- Effect on Human Health: Air pollution from vehicles and coal powered power plants.
- Impact on Aquatic Life by Oil Spills.

1.6 Area of Utility

- Wireless power and charging of devices in residential, domestic and industrial areas.
- Wireless charging and power to moving or mobile targets such as electric vehicles, fuel less plains, bikes, cars etc.
- LED lightning wirelessly eliminating need of batteries, cords, wires.
- Military Applications.
- Power can be supplied to remote areas easily by solar power satellite.
- Medical Applications

2. WIRELESS TECHNOLOGY

Wireless charging is based on the principle of magnetic resonance, or Inductive Power Transfer (IPT). This process of transporting an electrical current between two objects can be achieved through the use of coils to induce an electromagnetic field. So, to understand the Concepts behind the wireless

charging, we have to go get familiar with the terminologies associated with it. The transfer of Energy from the charger to Mobile is accomplished by mutual induction, governed by the Faradays law of Induction.

2.1 Faraday's Second Law

It states that the magnitude of emf induced in the coil is equal to the rate of change of flux that linkages with the coil. The flux linkage of the coil is the product of the number of turns in the coil and flux associated with the coil.

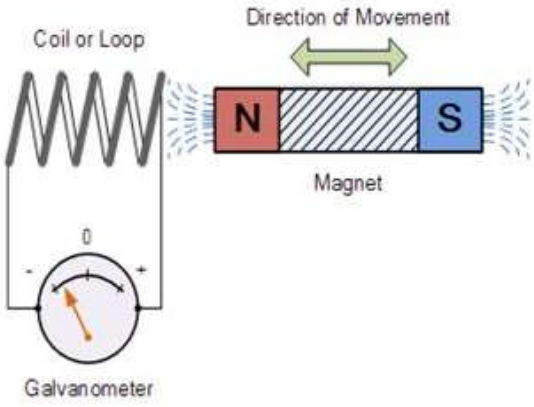

Fig.No. 1 Faraday Law

Faraday Law Formula

Consider a magnet is approaching towards a coil. Here we consider two instants at time T1 and time T2.

Flux linkage with the coil at time,

$$T_1 = N\emptyset_1 wb$$

Flux linkage with the coil at time,

$$T_2 = N\emptyset_2 wb$$

Change in flux linkage,

$$N(\emptyset_2 - \emptyset_1)$$

Let this change in flux linkage be,

$$\emptyset = (\emptyset_2 - \emptyset_1)$$

So, the Change in flux linkage

$$N\emptyset$$

Now the rate of change of flux linkage

$$\frac{N\emptyset}{t}$$

Take derivative on right hand side we will get

The rate of change of flux linkage

$$N\frac{d\emptyset}{dt}$$

But according to Faraday's law of electromagnetic induction, the rate of change of flux linkage is equal to induced emf.

$$E = N\frac{d\emptyset}{dt}$$

Considering Lenz's Law,

$$E = -N\frac{d\emptyset}{dt}$$

Where, flux Φ in Wb = B.A

B = magnetic field strength

A = area of the coil

Inductive charging (also known as wireless charging or cordless charging) uses an electromagnetic field to transfer energy between two objects through electromagnetic induction. This is usually done with a charging station. Energy is sent through an inductive coupling to an electrical device, which can then use that energy to charge batteries or run the device. Induction chargers use an induction coil to create an alternating electromagnetic field from within a charging base, and a second induction coil in the portable device takes power from the electromagnetic field and converts it back into electric current to charge the battery. The two induction coils in proximity combine to form an electrical transformer. Greater distances between sender and receiver coils can be achieved when the inductive charging system uses resonant inductive coupling.

The steps associated with the process of Wireless Charging are:

- Transmitter Circuit
- Receiver Circuit

The purpose of the Transmitter circuit is to transform the received voltage into high-frequency alternating current. After the high-frequency current is generated by the transmitter circuit it is fed to the transmitting coil in the very circuit. As the high-frequency alternating current is relinquished through the coil, it induces the magnetic field in the coil and the coil now operates as an electromagnet in accordance with the 2 and Law of Electromagnetic Induction. Now, as the magnetic field in one coil changes, and if the other coil is placed in the sufficiently close distance, the emf will be inducted into the neighbouring coil. The alternating current induces alternating flux in the transmitting coil which induces alternating magnetic flux in the core. As the core extends through secondary so some magnetic flux is linked with secondary also. Now, again the same reversed phenomenon will take place, the induced magnetic field in the Receiver coil will generate the alternating current into the receiver circuit in accordance with the faradays Law of induction. Hence the energy is transmitted from the Transmitter circuit to the

Receiving circuit through induction or coupling. Now in the last step, the induced alternating current is converted into required DC Voltage through a series of filters and Rectifier. At last the Stable current is fed into the battery for charging. Consequently, in this way, the wireless charging takes place.

2.2 Standard Wireless Power Technologies

When we talk about wireless charging technology, there are two most common prevailing technologies in the market. They are: Wireless Power Consortium (WPC) and the Power Matters Alliance (PMA). The Wireless Technology is in the market from a decade, in order to make this technology for the use of market consumers hence Wireless Power Consortium (WPC) was formed in 2008 to standardize the development of wireless charging solutions. After that PMA was introduced in 2012 to serve the same purpose. Both PMA and WPC are similar techniques and work on the same principle of Magnetic Induction but differs in the frequency of Operation and different connection protocols.

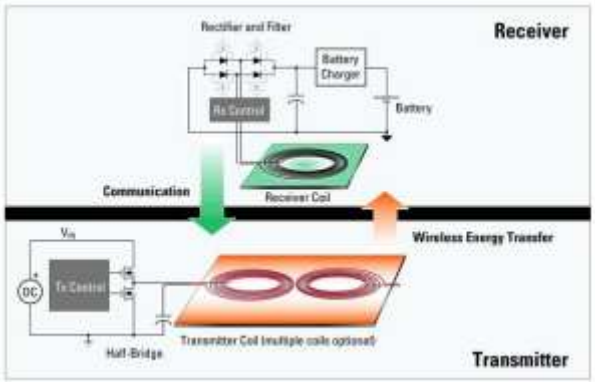

Fig.No 2 Working of Wireless Charging

3. BLOCK DIAGRAM

The transfer of power is based on the principle of Electromagnetic induction. The variable flux in primary coil links the secondary kept at some distance and hence EMF is induced in the secondary coil. Inductively coupled power transfer is most widely used method for short distances. Compensator plays an important role in both the primary side and the secondary side. The compensator consists of AC capacitors tuned in to resonate with the inductance at the supply frequency. The ripple protection circuit and filter removes the harmonic in the primary and secondary coil respectively.

3.3 Advantages

- Increase in number of charging station will boost the selling of EVs as their will be reduced range anxiety.
- It is always great for environment, if many EVs are being used in country.
- Its Initial installation cost is high due to non-availability of equipment in India. But all investment will eventually get recovered through charging station.
- It derives large power from grid, which increase load. Regions with lack of power may not be able to handle this load.

CONCLUSION

With the continuous improvements being made to the technology behind electric batteries, the electric vehicle finds itself playing a very important revolutionary role in the motor sport industry as a result. With the rapidly increasing number of demands for electric vehicles, the supply of its energy sources was bound to keep pace with its advancement. As for electric vehicle owners, the electric vehicle (EV) charging station serves the purpose of recharging the aforementioned built-in hybrid batteries.

REFERENCES

[1] Abdul Rauf Bhatti, Zainal Salam, Mohd Junaidi Bin Abdul Aziz, Kong Pui Yee, "A Comprehensive Overview of Electric Vehicle Charging using Renewable Energy", International Journal of Power Electronics and Drive System (IJPEDS) Vol. 7, No. 1, March 2016, pp. 114~123

[2] HooKah Khooi & Rashad Yazdanifard, "How to Plan and Strategically Manage an Electric Vehicle (EV) Charging Station", Global Journal of Management and Business Research: A Administration and Management Volume 15 Issue 4 Version 1.0 Year 2015

[3] Rajbansi Devmani Kamalbahadur, S. Prabhu Ram, Konar S. Suresh, M.R.Venugopalan, R.Karthikeyan, "Wireless Charging of Electric Vehicles by Solar Powered Charging Station", International Journal of ChemTech Research CODEN (USA): IJCRGG, Vol.10 No.14, pp 198-206, 2017

[4] Chuyue Chen and Guowei Hua, "A New Model for Optimal Deployment of Electric Vehicle Charging and Battery Swapping Stations", International Journal of Control and Automation Vol.7, No.5 (2014), pp.247-258

[5] Jayasudha Muthu, Sruthi Jarugumalli, Sundaresan Sabapathy "An Efficient Wireless Power Transmission For Future Transport System" International Journal of Pure and Applied Mathematics Volume 119 No. 14 2018, 1145-1151

[6] G.R. Chandra Mouli, P. Bauer, M. Zeman "System design for a solar powered electric vehicle charging station for workplaces Applied Energy 168 (2016) 434–443

[7] Vikash Choudhary, Satendar Pal Singh Vikash Kumar and 4 Deepak Prashar, "Wireless Power Transmission: An Innovative Idea", International Journal of Educational Planning & Administration. ISSN 2249-3093 Volume 1, Number 3 (2011), pp. 203-210

[8] Vikendra Patel1 Sandip Nakiya International Journal of Advance Engineering and Research Development Volume 4, Issue 12, December -2017 @IJAERD-2017, All rights Reserved 824 Scientific Journal of Impact Factor (SJIF): 4.72 e-ISSN (O): 2348-4470 p-ISSN (P): 2348-6406 Electrical power Transmission without Wire

[9] Puneet "Wireless Power Transmission", IJRET: International Journal of Research in Engineering and Technology Volume: 06 Issue: 01 | Jan-2017, 74

[10] Manish Bhardwaj, Anil Ahlawat "Wireless Power Transmission with Short and Long Range Using Inductive Coil", Wireless Engineering and Technology, 2018, 9, 1-9 Wireless Engineering and Technology