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# Wireless Charging of Battery in Electrical Vehicle using Solar Energy

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**ABSTRACT:** Energy is available in various forms from different natural sources such as solar energy, Nuclear energy and Chemical energy of fuels. The paper gives wireless charging techniques for electrical vehicle using solar energy. The fuel existing cars produces noise, air pollution and it produces major effects on an environment. But, the wireless charging technology overcomes these pollution problems. Wireless Power Transmission [WPT] is very reliable, efficient, and noiseless and pollution free technology.

**KEYWORDS:** WPT-Wireless Power Transmission, EV-Electrical Vehicle, IPT-Inductive Power Transfer, Renewable energy, ICPT, resonance, PP compensation.

## I. INTRODUCTION

Now a day the world is facing most serious problem is the energy demand [1]. Electrical energy is produced from energy available in various forms in the nature i.e. from the sun, water, wind & nuclear energy. Out of these sources, at present the sun energy is primarily used for generation of electrical energy. In the last two to three years wireless power transmission [WPT] is one of the fastest growing technologies for power transmission without using the cables. This newly advanced technology is very reliable & efficient. In present days, the wireless power transmission is become very necessary because to continue the driving electrical car thus it become a profitable. In the last two decades power transmission using inductive & magnetic coupling we see. This paper is to charge the battery by using solar energy & it can support more than one device & thus it becomes more beneficial. The power transmission using cables lost 25-30% of power & by using cables for power transmission it has many accidents but wireless power transmission is completely safe for human & thus, it is become safe for environment & for climate than the conventional cars. The Modern wireless power transmission techniques are more reliable & efficient. The Wireless Power Transmission has improved significantly in the last 2-5 years. The advantages of the Wireless Charging systems are -1) Variable frequency Possible 2) It can support more than one device.

## II. LITERATURE REVIEW

Nikola Tesla was the first who invented this Wireless Power Transmission [WPT] technology in 1890. He wanted to create the supply system without use of the wire thus he invented inductive & capacitive coupling system for the Wireless Power Transmission. He invented coil known as a Tesla Coil.

Erhuvwu Ayisire has given the idea related to charging system for Electrical vehicle [EV] [2]. N. Uthaya Banu, U. Arunkumar, A. Gokulakannan, M. K. Hari Prasad & A. B. Shathish Sharma has given the knowledge about the battery charging by using a solar energy & it is also analysed primary & secondary side in detail [1]. The most difficult & important part while designing wireless charging system that is designing part of a coil. This paper gives knowledge about the Wireless Charging in Electrical Vehicle by using the Solar Energy.

## III. NECESSITY

The Wireless power transmission has attracted the lots of the researches due to the several advantages. The Global Warming becomes the most dangerous problems in now a day [1]. The wired charging has the many drawbacks. To resolve the problems of wired charging system now days, wireless power transmission technology becomes more useful.

## IV. EXISTING SYSTEM

In current scenario fossil fuel, based vehicles are used for transportation, which causes huge amount of greenhouse gases emission, and the fossil fuels are in a verge of extinction. To avoid this electric vehicles were introduced but the

major problems with electric vehicles is its charging related issues such as long charging time, charging one vehicle at a time & insulation requirement in charging cable.

### V. PROPOSED METHOD

This paper proposes the concept of WPT at public parking places for charging electrical vehicles. The Figure 1 shows the model of proposed system. The block diagram in figure 2 consist of the three major parts of this model the transmitter, the receiver & the track. The design for the coupler for static & dynamic charging of the electric vehicles. The charging pad is used to reduce the wastage of flux losses. This paper also states the effect of compensator in both the primary & secondary coil.

Figure 1: Prototype model of WPT for electric vehicle

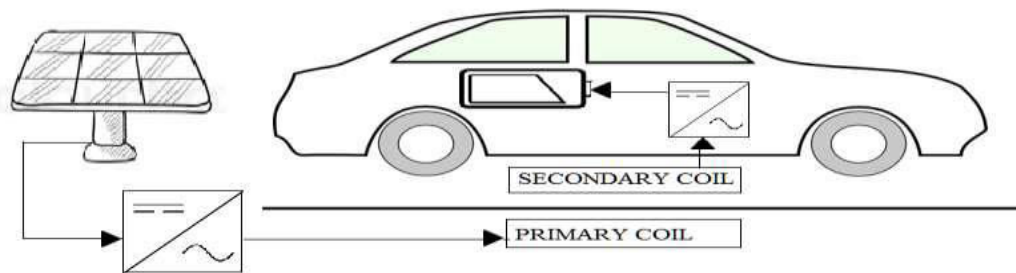
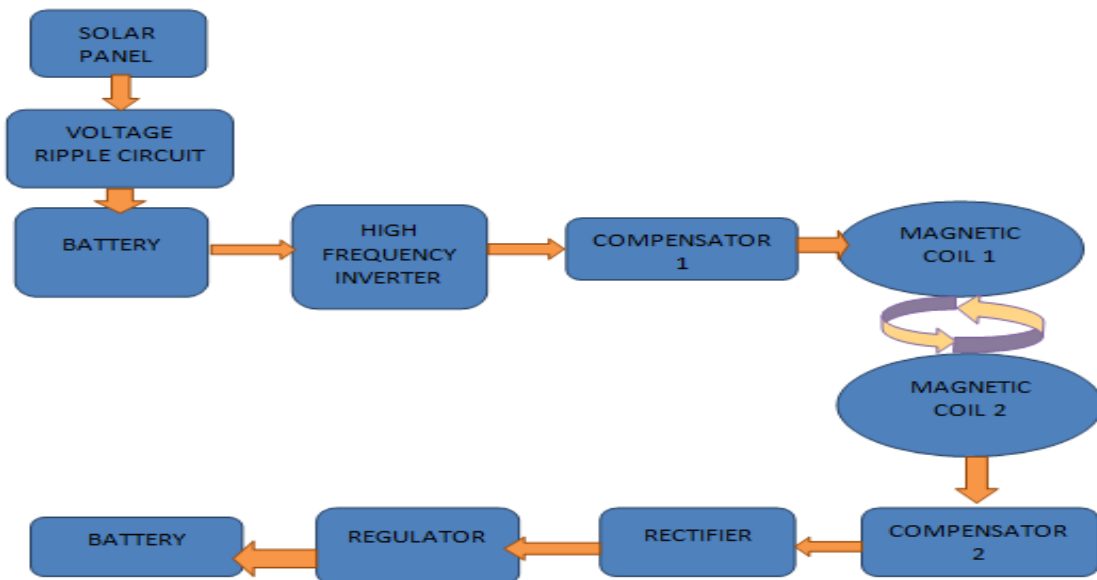


Figure 2: Block diagram of proposed method



The solar panels are kept at a height in which it provides shades to the vehicles and generates the supply for this model. It uses the solar energy & converts it into electrical energy through photovoltaic effect. The voltage ripple circuit removes the ripples from the input supply & provides a constant dc supply voltage & it is stored in a battery & which supplies the high frequency inverter. The high frequency inverter generates high frequency AC current by using power electronic switches. According to Ampere circuital law, this high frequency AC current flowing in a primary coil produces variable flux in the vicinity. The primary coil which is made up of a copper wire is placed on a track below the parking station floor. A compensator circuit is connected in parallel to the coil in this model, which cancels the inductive power at resonating frequency & eliminates the harmonics. The track consists of aluminum shielding which concentrates the flux to receiver. The receiver is basically a secondary coil placed at the bottom of the electric vehicles. Due to the electromagnetic induction principle is induced in the secondary coil. A compensator is connected in parallel

to the secondary coil, which forms a resonating tank circuit in order to remove the harmonics & the ripple contents. The secondary is connected to the full bridge rectifier which converts AC to DC. The regulator circuit is used to get a constant DC supply, which charges the battery of the electric vehicle.

### VI. COMPENSATOR THEORY

ICPT uses the principle of electromagnetic induction for the transmission of energy from primary to secondary coil, but due to the huge air gap between the primary & the secondary coil lot of flux doesn't link the secondary coil. To save this flux loss, resonance condition can be used & hence obtain the maximum power transfer between the primary & the secondary for a given distance. For this compensators are used which consist of AC capacitors connected with the respective coil in series & parallel. Depending on this connection the basic compensation topologies are [3]: Series-series topology, Series-parallel topology, Parallel-parallel topology, Parallel-series topology. The capacitor C1 in primary is used to cancel the reactive part of the circuit seen by the source, achieving zero displacement. Thus the inductive power in primary coil is being cancelled by the capacitive power, thus the primary coil impedance is equivalent to the net resistance in the primary circuit. The capacitor C2 in the secondary side is chosen to operate in the resonating condition, thus the net inductance in the secondary coil is cancelled by the secondary compensator, & hence achieving maximum power transfer. The operating frequency must be the resonating frequency of a circuit, which is determined by the inductance of the coil & capacitance of the compensator given by the equation (1). The resonating frequency of the primary & the secondary must be the same. Thus the operating frequency determines the capacitance of the compensator & is limited by the maximum frequency of the inverter  $f_{max}$ .

$$F = \frac{1}{2\pi\sqrt{LC}} \dots (1)$$

In lower power levels, when cross-section of a wire is not an important parameter, the Parallel-Parallel (PP) compensation is advantageous to operate at larger distances at the same operating frequency [4]. Parallel- Parallel topology is given in figure 3.

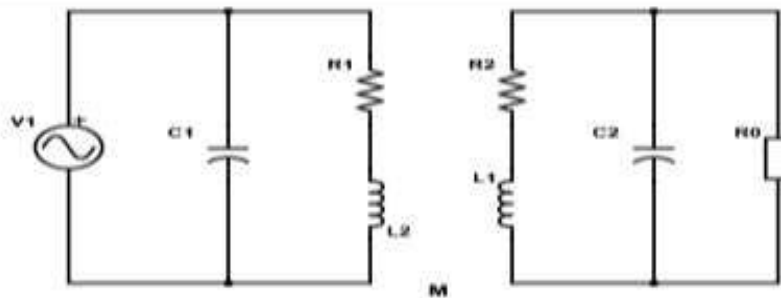


Figure 3: Equivalent circuit of PP compensation

### VII. IMPLEMENTATION PLATFORM

#### Implemented system

The hardware consists of a 24V Solar panel which is connected to voltage ripple circuit. The voltage ripple circuit removes the ripples & gives out a constant voltage output. This output from the voltage ripple circuit is used to charge the battery which is used as a source to charge the battery using wireless power transfer. The battery serves as an input for the primary coil which is present in the charging pad. The DC power is fed to primary coil through the high frequency inverter circuit. The high frequency converter consists of BA129 transistor which is triggered by Arduino Uno at high frequency. This converts DC input from the battery to high frequency AC which is passed through the primary coil. Then the high frequency AC is generated in secondary coil which is present in the base of the car whose battery is to be charged. This high frequency AC is converted into DC by a full bridge rectifier. This DC is passed through the regulator to get constant DC output which is used to charge the battery.

### VIII. CONCLUSION

Fuel based transportation is caused huge pollution issues. The uses of the electric vehicles in present situation provides an eco-friendly solution but suffers from huge drawback when comes to charging. Thus ICPT principle is used to provide the advantageous alternative. This project thus provides a model which can be used for the wireless charging at various parking stations at public places powered by solar energy. This paper also dealt the effect of parallel-parallel

(PP) compensator in both load & source side & has analyzed the variation of output voltage with distance between the coils. The model is scaled in 100:1 ratio with power level up to 15 watts & the considerable power is transmitted up to 35mm using PP topology which when scaled at real time will give the better efficiency.

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