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Wireless Power Transfer Technology (WPTT) - Through Resonance

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Abstract: All of the electronics devices needs power and the power given wirelessly to devices like embedded or real time systems, gets more advantages. The major issue of the consumer products is the short life of battery even in high technology support systems. Many researches are going on with wireless power transfer technology via magnetism, microwaves, resonance etc... One method resonance is covered in this paper.

Keywords: Wireless power transfer technology (WPTT), Resonance, Resonance frequency, Magnetic Coupling.

I. INTRODUCTION

Wireless power transmission is basically the transfer of required power or electrical energy from one source to another destination without using wires fig(1). Mainly applicable to smart phones, laptops and hand hold digital equipments.[1][4] some sort of embedded or real timed systems need not use batteries for its working by the application of WPTT.

Fig. 1

II. PRINCIPLE OF OPERATION

WPTT in resonance method uses the concept called 'coupled resonance' -that is one circuit is coupled with another circuit through resonance fig (2). Consider two self resonating copper coils with same resonance frequency with same diameter of say both 25 inches. One coil is connected in source power can call it WPT transmitter and the other coil is connected to the destination device called WPT receiver.

In the WPT transmitter the electric energy from the power source makes the copper wire to oscillate in the same frequency in terms of few thousand KHz, same time the area surrounded the coil filled with magnetism radiations.[5] This magnetic field transfers the power to the destination receiver, the coil at the WPT receiver also start oscillating at the same frequency of that in the transmitter -called coupled resonance.

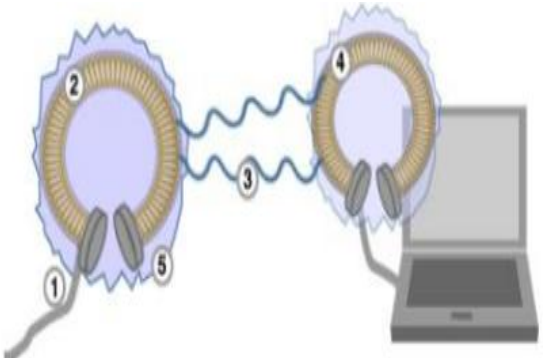

Fig. 2. Resonant power transfer

In fig 2. 1- Power from power source-First copper Coil,
2- Resonates coil or antenna for e.g. frequency of 5500 KHz,
3- Magnetic field covers at a distance of about 4 to 6 meters,
4- Coil 2 comes under the area of magnetic field and resonates at the same frequency of transmitter coil and reproduces electric energy back and use the device for charging or its working,
5- Some energy is not transferred to the receiver that is not under the area receiver and no other device can accept or affected because of no other receiver resonates the same frequency of 5500 KHz.

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III. WPTT THROUGH MAGNETIC RESONANCE (USING TRANSMISSION COIL)

A WPTT via magnetic resonance has been doing many groups, by using transmission coil, as per this system we get more efficiency. In this system two coils- one for transmission and the other for reception is needed. The efficiency of transfer is a function of distance and positions of the coils. Efficiency and distance are inversely proportional and if the coil shares a single axis or position, the efficiency is maximum. To improve the efficiency we can implement a third coil in this transmission system, this coil is not connected to any devices but it issued to improve the efficiency only. This third coil can be placed anywhere in the system to make the field effective.

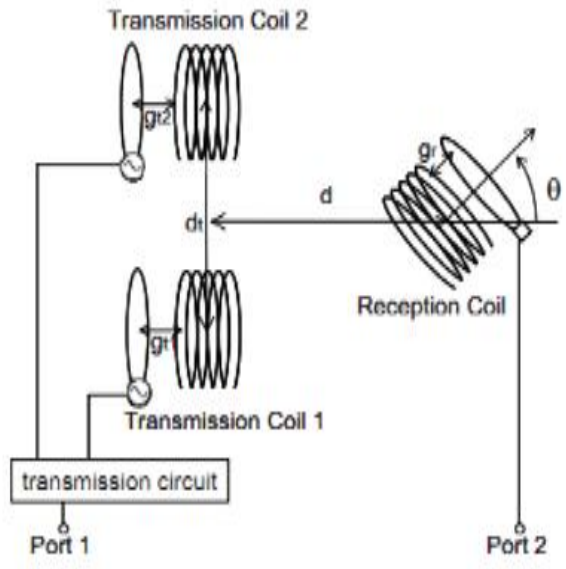

Fig.3. WPTT using transmission coil

IV. BLOCK DIAGRAM & WORKING

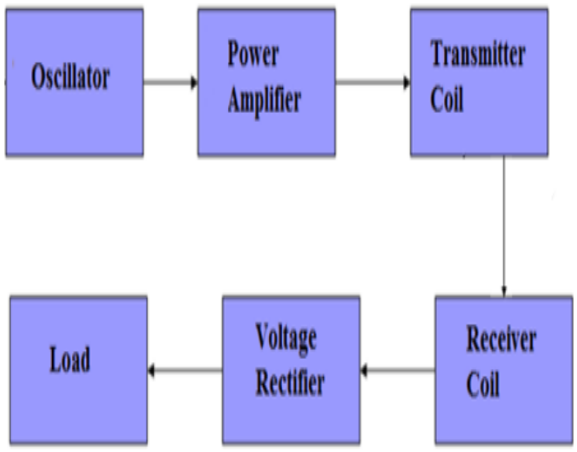

Fig.4. Block diagram

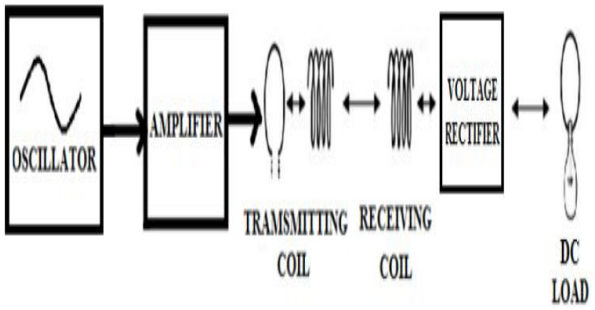

Fig.5. Block diagram

Oscillators may be classified as Sinusoidal and Relaxation types. Sinisoidal oscillator may be worked with operational Amplifiers having positive and negative feedback to make a continuous rate Oscillations.
But in relaxation type operational amplifier oscillators operate with a current source and a capacitor, due to the charging and discharging of capacitor makes oscillations.[6][7]

Producing maximum amount of magnetism flux for inducing large voltage at the receiving coil needs huge amount of current must be delivered in to the transmitting coil. The oscillator itself is not able to supply large current, so we use a power amplifier to produce necessary current and the power amplifier is designed without much harmonic distortions.

Coupling circuit is the combination of transmitting and receiving circuit. This is the key section of WPTT system using magnetic resonance. The efficiency of this section defines the overall efficiency of the system or the amount of power received by the destination device.

Rectifier circuit normally a full wave bridge rectifier using semiconductor diodes are used to rectify the AC energy received at the receiver to drive a DC load.. Normally all of the electronic systems are powered with DC.
In combination with rectifier a filter circuit is also used to filter the AC ripples and a DC Regulation circuit of necessary voltage may be used to get constant accurate voltage.

V. WIRELESS POWER TRANSMISSION USING STRONGLY COUPLED RESONANCE

A very suitable method that is applicable to electronic devices such as laptop, cell phones, robots and PDAs by using resonance frequencies to multiple sources. Gets portability and regular charging can be done by plugging into a wall out let.[9]. Radioactive power transfer, is used in wireless communication, is not suitable for power transmission because of its low transfer efficiency and radiation loss due to its circular directional nature.

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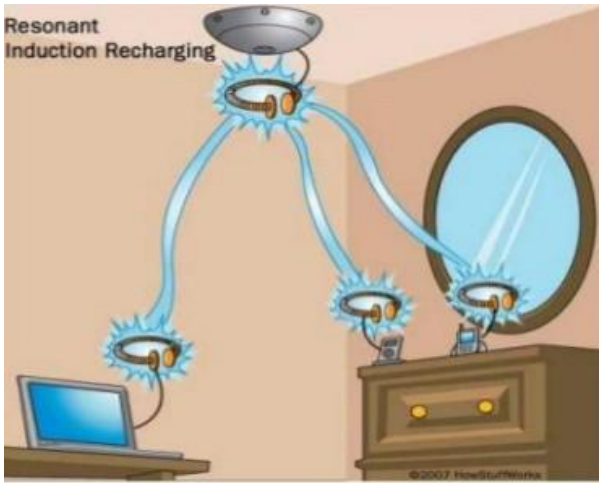

Fig.3. Same resonance frequencies to multiple devices

In order to get Efficient Power transfer in strongly coupled resonance, some ways are used for tuning the parameter coil system so that it is operated in strongly coupled region.[2][3] Coupled Mode Theory (CMT) gives accurate way of modeling the system.

VI. DISCUSSIONS & CONCLUSION

Today the increased demand of consumer embedded electronics systems many studies of WPTT is going on .with the many available methods more suitable method may be implemented soon. Also the future innovation regarding WPTT is the large scale power distribution systems. That is it creates a link between consumer and power generation plants. WPTT system can completely eliminates the wired systems of distribution, able to transmit power to the areas that is not possible for wired system and also the distribution power loss is less. Power is always available when WPTT System is working so can avoid the power failure due to fault on cables and short circuit.[8][10] Adopting WPTT system - the initial implementation cost is very high and a challenge of avoiding interference of present wireless communication systems.

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