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A Novel Approach on Wireless Power Transmission Using Resonance Circuit with Multiple Coil Switching Technique

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***Abstract*—The purpose of this paper is to discuss concept of transmitting power without wires. Using resonant coupling Wireless transmission of power is the transmission of electric power without use of any wired medium. In this paper we analyses and designs wireless power transmission using magnetically coupled resonator with the multiple coil switching techniques. Resonant coupling Wireless transmission is useful in cases where instantaneous or continuous energy transfer is needed, but interconnecting wires are inconvenient, hazardous, or impossible. With this we can avoid complexity and risk of wiring. By means of coil windings distance and efficiency can be increases. Due to it does not effect surrounding atmosphere. This method most convenient than other wireless power transmission where media for transmission of power is easiest and cheapest.**

Index Terms—Microcontroller, Power, Resonant coils

I. Introduction

In the 1890's, famous scientist and engineer Nikola Tesla demonstrated the wireless transmission of electrical energy, based on the principle of electric conductivity [1]. This was achieved using big, coupled electromagnetic resonators, able to generate very large electric fields. Tesla concluded that the earth is an excellent electrical conductor, and an electric current can be made to propagate undiminished for distances of thousands of miles. Due to financial problems, this idea was abandoned and copper cables became the basis for modern electricity infrastructure. In 1964, William C Brown demonstrated a microwave powered model helicopter. In 1975, Brown was technical director of a JPL Raytheon program that beamed 30 kW over a distance of 1 mile at 84% efficiency using microwaves.

In recent times, several companies like Witricity Corp and Splash power came into existence, that have developed technologies for charging small gadgets, such as cell phones and cameras, using electromagnetic induction. Wireless transmission of electricity will enable "self-charging" of these devices and thus, is the need of the hour. By providing electricity wirelessly to these electronic devices, it is possible to eliminate our dependency on bulky, heavy batteries and power cords, thereby making these wireless devices portable in all respect. This emerging technology was demonstrated by Eric Giler, CEO of the US firm WiTricity, at the TED Global Conference held at Oxford in 2009. In this demonstration, Giler showed a WiTricity power unit powering a television as well as three different cell phones. In 2009, Sony shows a wireless electro dynamic-induction powered TV set, 60 W over 50 cm. Haier Group debuts "the world's first" completely wireless LCD television at CES 2010.Electric tooth brushes and wireless charging pads are currently used in day to day life. Presently, the project is looking for power transmission in the range of 100watts. Efforts are being taken to develop "WiTricity" (term for wireless electricity) devices, which are capable of charging laptops and other portable devices with increased efficiency. This technology is still in the development stage and lots of work is to be done in improving the range and efficiency of power transmission.

II. Basic Principle Of Resonant Magnetic Coupling

The basic principle employed in our project is Resonant Coupling between the transmitter and receiver. Resonant Magnetic Coupling occurs when two inductively coupled objects, having the same resonant frequency, are in resonance. These two objects (in our case, the source coil and receiver coil) tend to exchange energy efficiently, whereas the interaction with the extraneous off-resonant objects and the surrounding is minimal [1].Inductive coupling uses magnetic fields that are generated when current flows through a wire. When electrical current flows through a wire, it creates a circular magnetic field around the wire. Bending the wire into a coil amplifies the magnetic field. The more loops the coil makes, the stronger is the field. It is possible to extend the distance between coils in inductive coupling system by adding resonance condition. By sending electromagnetic waves around in a highly angular waveguide, evanescent waves are produced, which carry no energy. An evanescent wave is a near field standing wave exhibiting exponential decay with distance. Evanescent waves are always associated with matter, and are most intense within one-third wavelength from any radio antenna. Evanescent means tends to vanish, the intensity of transient waves decays exponentially with the distance from the interface at which they are formed. If a proper resonant waveguide is brought near the transmitter, the evanescent waves can allow the energy to tunnel to the power drawing wave guide, where they can be rectified into DC power Since the electromagnetic waves would tunnel, they would not propagate through the air to be absorbed or dissipated and would not disrupt .electronic devices or cause physical injury

like microwave or radio waves transmission.

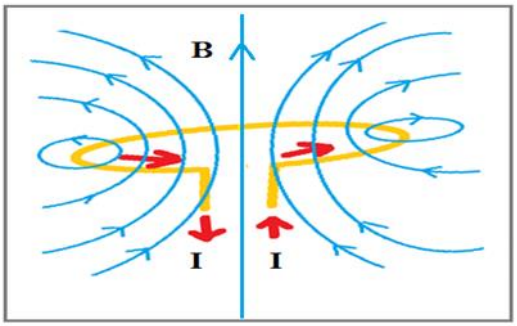

Fig. 1. Magnetic field for a conductor loop

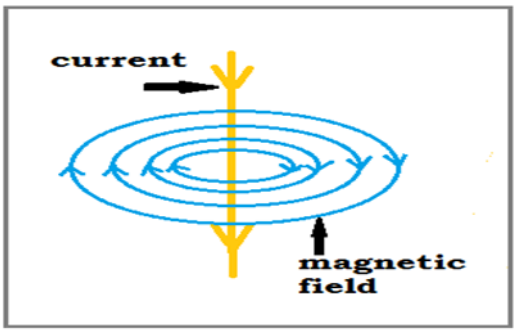

Fig. 2. Magnetic field for a straight conductor

III. Functional Block Of Wireless Power Transmission Using Resonant Coils

Our experimental scheme consists of two independent parts: The transmitter and the receiver which are linked together by a magnetic field. There are two types of sources used to power up the circuit which are solar panel and A.C. supply of 230V. Both sources will first charge the 12V battery and output of battery is given to the circuit. The solar panel should be used as primary source where A.C. source should only be used when solar panel gets discharged. The transmitter consists of an AC/DC converter, a frequency oscillator, a power amplifier and a copper coil which acts as an antenna. The AC to DC converter will convert the 230V, 50Hz AC mains supply to a 12V DC voltage which is given as supply voltage to the frequency oscillator. The oscillator circuit generates a signal whose frequency is equal to the resonant frequency of the source (transmitting) and device (receiving) coils.

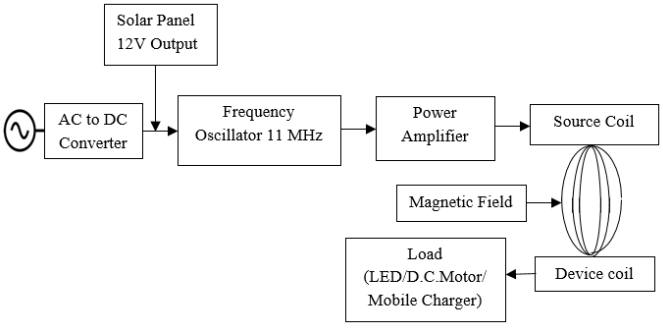

Fig. 3. Functional block diagram

Fig. 4. System design and measurements

The output of the oscillator is given to the power amplifier. The power amplifier amplifies the signal and drives the transmitting coil (source coil). The source coil and device coil are identical copper coils having the same resonant frequency (here, 11.0592 MHz). They act as antennas for this transmission. When the signal passes through the source coil, a magnetic field is set up. Since the frequency of the driving signal is equal to the resonant frequency of the coil, resonance occurs. Thus, resonant magnetic coupling takes place between the two inductively coupled coils and energy is efficiently transferred. The magnetic field generated by the source coil links with the device coil and emf is induced in it. A current is generated because of the induced emf and thus, the load is powered.

TABLE I
RESULTS

S. No.	Application	No. of gauge	No. of turns
1	LED Strip	23	45
2	Mobile Charger	23	60
3	D.C. Motor (Fan)	23	85

IV. FUTURE SCOPE

WPT, if successful will definitely change the way we live. Imagine cell phones, laptops, digital camera's getting self-charged. Let's hope the researchers will be able to come up with commercial system soon. A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

V. CONCLUSION

Magnetic resonant coupling is an efficient way of energy transmission as it is a non-radiative mode of energy transfer, relying on the magnetic near field. It is more efficient than inductive coupling. Magnetic fields interact very weakly with biological organisms. It is safe to use and eco-friendly. The efficiency can exceed 95% if the source and receiver are very close to each other. It is possible to transfer power efficiently even when the distances between the power source and capture device are several times the size of the devices themselves. The range of transmission depends upon the size of the source coil. The distance over which power can be transmitted is 8 times the radius of the source coil. The transmission distance is independent of the size of the receiver coil and thus, the size of the receiver coil can be reduced to such an extent that it can be embedded into various devices like cell phones, laptops, etc. However, one important thing to be kept in mind is that the source coil and receiver coil should have the same resonant frequency. Since magnetic near field is transparent to common materials, it is possible to embed the source coil in the wall or in the ceiling. Thus, the unpleasant and bulky setup can be hidden without affecting the efficiency in any way. It is possible to power multiple devices using single source coil. We can also have multiple source coils for load distribution purpose. It is not necessary for the coils to be of circular shape. It can be rectangular too and can complement the aesthetical features of your house/office. Wireless Electricity concept is a boon for devices which use midrange energy. Using this concept, it is possible to eliminate society's dependency on heavy and bulky batteries

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