MITIGATING RESEARCH ISSUES IN WIRELESS POWER TRANSMISSION USING STRATEGIC APPROACHES

Dr. K. Sujatha[1], Dr. J. Janet[2], Dr. D. Shalini Punithavathani[3]
[1]Associate Professor, Department of Computer science and Engineering,
Sri Krishna College of Engineering and Technology, Coimbatore, Tamilnadu, India.
[2]Principal, Sri Krishna College of Engineering and Technology, Coimbatore, Tamilnadu, India.
[3]Professor & Principal (Rtd.), Government College of Engineering, Tirunelveli, Tamilnadu, India.

Abstract

Today laptops, computer, mobile robot and electric vehicles are proficient in charging itself deprived of being operated with. Televisions and digital picture frames which hangs in do not need cables and plugging for power supply. Engineering structures and therapeutic strategies shall be prepared more dependable in eradicating distress prone wiring and expendable batteries. The method feats modest physics and shall be employed for charging a variety of electrical devices over several meters. These systems shall substitute the miles of affluent power cables and billions of offhand batteries. There is somewhat like 40 billion disposable batteries built every year for power that is employed inside little inches or feet of where there is very low cost power. If this expertise is acknowledged in forthcoming days, it shall brand ordinary products to be more expedient, dependable, and ecologically approachable. This paper comprises of methods for transmitting power deprived of wires with improved effectiveness, due to which it does not disturb the atmospheric surroundings.

Keywords: Wireless power transmission, inductive pairing, transformers, wireless electricity and power transmission.

1. INTRODUCTION

The next step to making our lives truly mobile is getting free of the tangles of power cables lurking in all our homes. Unless you are particularly planned and good with tie wrap, you possibly have a little dusty power cord tangles around your home. You may have even had to follow one particular cord through the apparently impossible snarl to the outlet, hoping that the plug you pull will be the right one. Moreover a great anxiety has been voiced in recent years over the extensive use of energy, the limited amount of resources and the pollution of the environment from the use of present

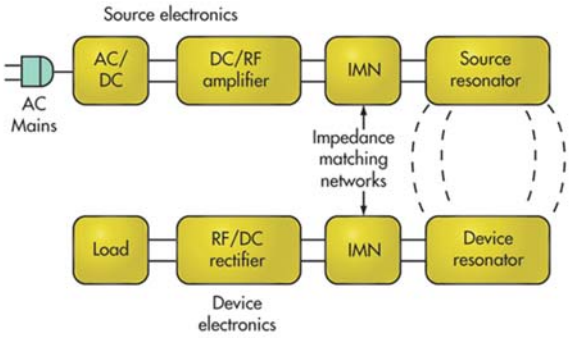

Figure 1: An articulation of wireless power transfer

energy conversion methodologies. Electrical power accounts for much of the energy utilized. Much of this power is unused during transmission from power plant producers to the consumer. The resistance of the wire used in the electrical grid distribution system causes a loss of 26-30% of the energy generated. This loss infers that our present system of electrical distribution is only 70% capable. A system of power supplies with tiny or no loss would conserve energy. It would decrease pollution and costs resulting from the essential to generate power to overcome and compensate for losses in the present grid system. For these reasons, scientists have tried to develop methods of

wireless power transmission that could cut the disorder or lead to clean sources of electricity. Nikola Tesla spent much of his productive life testing with wireless power [1]. The familiar tesla coils are actually a resonant wireless power transmitter. Figure 1 shows the basic articulation of wireless power transfer mechanism, by which the uses of cables are avoided.

II. THE CONCEPT OF WITRICITY

WiTricity is nothing but wireless electricity. Transmission of electrical energy from one object to another without the use of cables is called as WiTricity. WiTricity will ensure that the cellphones, laptops, iPods and additional power hungry devices get charged on their own, removing the need of plugging them in the system is shown in Figure 4. Even better, because of WiTricity some of the devices need not require batteries to operate. Wireless electricity or witricity is the process that takes place in any system where electrical energy is transmitted from a power source to an electrical load without joining wires. We can also call it as Wireless energy transfer or wireless power transmission. This technology avoids the use 40 billion throwaway batteries built every year for power that is used within a few inches or feet of where there is very inexpensive power. The typical battery is shown in figure 2. and the figure 3 shows that the Percentage disposal of lead-acid batteries for various materials.

Figure 2: Disposal of dry batteries

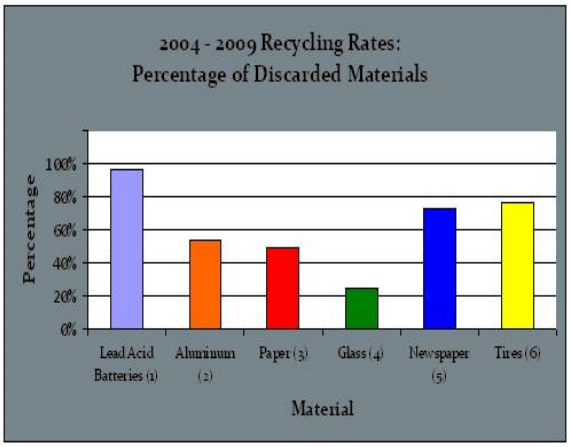

Figure 3: Percentage disposal of lead-acid batteries

III. THE PRINCIPLE BEHIND WIRELESS ELECTRICITY

The principle behind the wireless electricity is called Coupled Resonance. Magnetic coupling occurs when two objects exchange energy through their varying or fluctuating magnetic fields. Resonant coupling ensures when the natural frequencies of the two objects are almost the same. WiTricity power sources and capture devices are specially designed magnetic resonators that capable to transfer power over large distances via the magnetic near-field. These proprietary source and device designs and the electronic systems that regulate them support efficient energy transfer over distances that are many times the size of the sources/devices themselves.

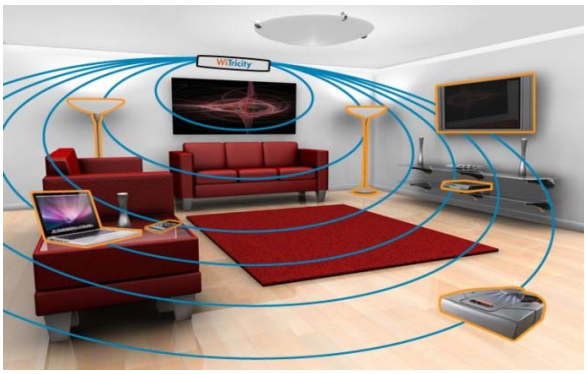

Figure 4: The Concept of witricity

Consider two self-resonating copper coils of similar resonating frequency with a diameter 20 inches each one**.** One copper coil is connected to the power source, while the other copper coil is connected to the device. The

concept behind the structure is shown in figure 5.Additionally a capacitance plate which holds charges is attached to each end of the coil to improve the range of transmission. The resonant frequency is a multiple of the inductance of the coil and the capacitance of the plates, therefore the range of transmission is increased [2].

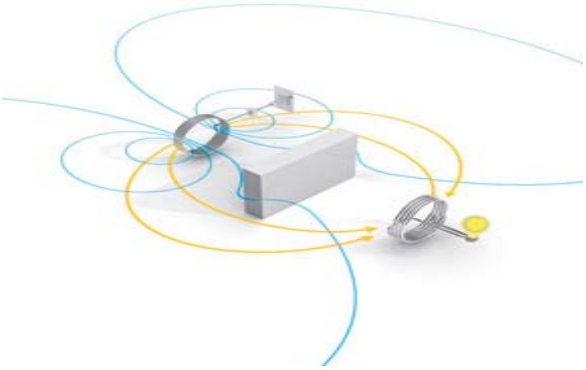

Figure 5: Two idealized resonant magnetic coils

The electric power from the power source causes the copper coil connected to it to start fluctuating at a particular (MHz) frequency. Subsequently, the space around the copper coil gets completely fiilled with nonmagnetic radiations. This generated magnetic field further transfers the power to the other copper coil connected to the receiver. Since this coil is also of the same frequency, it starts fluctuating at the similar frequency as the first coil. This is known as coupled resonance and is the principle behind WiTricity.

There are variety of methods to transmit power without wires. Omni-directional radiative antennas are one of the most widely used technologies, since they can operate in all directions and do not require a line of sight to the receiver, they are very inefficient. Only a little portion of the radiated power in the direction of the receiver is actually picked up, since the huge majority of the radiation is lost in all the other directions. The use of a highly directional antenna, such as a microwave-beam antenna, in principle solves this problem and achieves a high efficiency in power transmission even over lengthy distances is shown in figure 6.

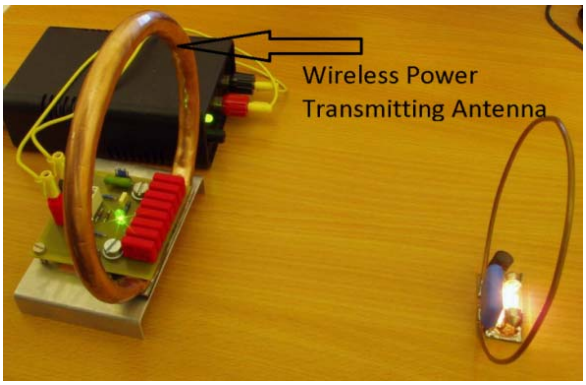

Figure 6: Wireless power transmitting antenna

On the other hand, this type of antenna does need an uninterrupted line of sight, which in itself requires a difficult device-tracking and beam-steering mechanism [3]. Also, high-power focused beams may establish a safety hazard. another approach to antennas is the usage of an inductive transformer, a device commonly used in power circuits and electromechanical motors. The various types of inductive coupling structure is shown in figure 7.

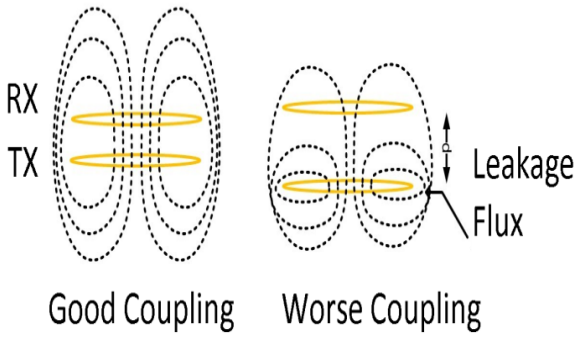

Figure 7: Inductive coupling

A transformer typically operates up to mid-kHz frequencies. It fundamentally transfers electrical energy from one circuit to alternate via induction, the time-varying magnetic flux produced by a primary coil crosses a secondary coil and generates a voltage. The primary and the secondary coils are not actually connected, hence the method is wireless. Transformers can be very capable but the distance between the coils must be very small. For distances a few times the size of the coils, the efficiency falls significantly. Part of the primary physics for most of the conventional approaches for the wireless transfer of electricity is the essential principle of resonance the property of certain physical systems to fluctuate with maximum amplitudes

at certain frequencies. Based on scientist Nicola Tesla planned theories of wireless power transmission, researchers have established several techniques for moving electricity over long distances without wires. This method of transferring electric power is based on the principle of Inductive coupling. Ordinary electrical connections could also permit water to seep into the toothbrush, damaging its components. Because of this, maximum toothbrushes recharge through inductive coupling, which works in the same principle of Transformer. Another example for present day WiTricity is the Splash power recharging mat and Edison Electric's Power desk both use coils to generate a magnetic field. Electronic devices use equivalent built-in or plug-in receivers to recharge while resting on the mat. These receivers contain compatible coils and the circuitry necessary to deliver electricity to devices' batteries.

IV. MEDICAL APPLICATIONS OF WITRICITY

MILLIONS of people around the world benefit from having artificial pacemakers embedded into their chests, to help restore a normal heartbeat is shown in figure 7. Yet pacemakers are not without problems.

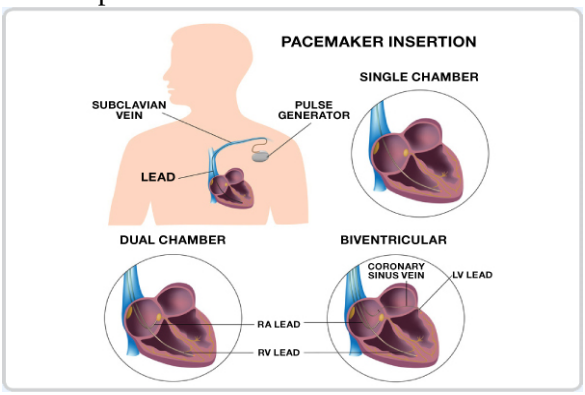

Figure 7: Pacemaker inside the human body

The bulk of the device-which contains its battery and electronic control systems commonly, sits just under the wearer’s skin. From this box thin, flexible leads are threaded through a vein and into the suitable part of the heart. These leads detect the heart’s electrical activity. Fitting the body of an artificial pacemaker is simply easier. Fitting the leads, though, can be tricky; difficult, even, in some patients. And if the leads fail, eliminating them may require major surgery. They also bring risk of infection. As a solution to that, Medtronic is using microelectronics to make a pacemaker so small it can be introduced. It is said to be the size of a tic-tac only. Medtronic is making the device safer as well as smaller. At just a fraction of the size of current devices, the novel pacemaker could be injected using a catheter and a small incision. No more required to slice open the upper chest and create a pocket to hold the pacemaker. No more essential to run leads down veins into the heart. A single incision, a single implantation of a tiny device, and Medtronic’s future patients would be done.

V. CONCLUSION

The majority of the device which contains its battery and electronic control systems usually sits just under the wearer’s skin. From this box thin, flexible leads are threaded through a vein and into the suitable part of the heart. These leads identify the heart’s electrical activity. There are hundreds of thousands of people with pacers in the world, tens of thousands with brain implants, millions total who have corrective implants of some variety. Looking past this pacemaker, we trust that there are even smaller and more capable devices on our horizon. Wireless Electricity may be the solution to more efficient and new ideas for the future. Imagine cellphones, laptops, digital camera's getting self-charged, if made commercial will definitely change the way we live. Millions of people around the world benefit from having synthetic pacemakers inserted into their chests, to help restore a normal heartbeat.

References

[1] Hiroshi Matsumoto, “Microwave Power Transmission from Space and Related Nonlinear Plasma Effects” Space and Radio Science Symposium: 75th Anniversary of URSI, 26-27 April 1995, Brussels, Belgium, pp. 155-190.

[2] W.C. Brown, “Experiments Involving a Microwave Beam to Power and Position a Helicopter”, IEEE Transactions on Aerospace Electronic Systems. Vol. AES-5, no. 5, pp 692-702

[3] W.C. Brown, IEEE Transactions on Microwave Theory and Techniques, vol. MTT-32, 1230 (1984).