ISSN: 2470-3206

International Journal of Nanomedicine and Nanosurgery

Editorial Volume: 2.2 Open Access

Towards the Design of Body Devices with Wireless Power

Nikita Ahuja, Mary Mehrnoosh Eshaghian-Wilner*, Zhuochen Ge, Renjun Liu, Alekhya Sai Nuduru Pati, Kodiak Ravicz, Mike Schlesinger, Shu Han Wu and Kai Xie

Department of Electrical Engineering-Systems, University of Southern California, USA

***Corresponding author:** Mary Mehrnoosh Eshaghian-Wilner, Department of Electrical Engineering-Systems, University of Southern California, USA, Tel: (213) 740-6257; **E-mail:** eshaghia@usc.edu

Received date: 23 Mar 2016; **Accepted date:** 28 Mar 2016; **Published date:** 02 Apr 2016.

Citation: Ahuja N, Eshaghian-Wilner MM, Ge Z, Liu R, Nuduru Pati AS, et al. (2016) Towards the Design of Body Devices with Wireless Power. Int Nanomed Nanosurg 2(2): http://dx.doi.org/10.16966/2470-3206.e104

Wireless charging is now increasingly applied to medical technology and holds great potential for the advancement of health care. The initial impetus for wireless power research was a desire to advance mobile devices: because improvements to mobile devices are limited by the size and life of their batteries, researchers sought to work around such limitations by harnessing the potential of wireless power. The wireless power technology that exists today makes it possible to conveniently charge mobile devices without the burden of power cords. While there are many challenges involved in applying existing wireless power technology to the medical field, the hope is that this transition will make tools like implantable medical devices available for patient treatment.

Since its inception, wireless power transfer has been gradually advanced by a number of researchers, with each improvement to the technology increasing its implementation beyond the confines of the lab. There are three major approaches to wirelessly transferring power: the microwave approach, inductive coupling, and magnetic resonance coupling. While using microwave frequency at first seemed promising because the method combined high efficiency with low energy loss, the implementation of the microwave approach proved to be impractical because it required customization based on the devices and components being used in the given situation. Following the microwave approach, the idea of inductive coupling was born. Inductive coupling involves producing electric current by manipulating the magnetic field. While the inductive coupling approach does offer more versatility than the microwave approach, it is not practical to transfer power via electromagnets because the efficiency of such an operation is far too low. Most recently, a third approach for wireless power transfer-magnetic resonance coupling-was developed to capitalize on the potential of the microwave approach and inductive coupling approach while working around the individual limitations of both methods. Magnetic resonance coupling for the first time allowed engineers to transfer power from the sender to the receiver by harnessing the interdependence of the electrical and magnetic fields. Adding to the effects of this new and more effective approach was the transition from using antennas to using magnetic coils, boosting efficiency. Eventually, magnetic resonance coupling became the predominant approach for technologies involving wireless power transfer and it is currently the best approach we have to move forward with. In examining the history of wireless power transfer development, we can see that continual innovation has resulted in steady progress. Today, with technology in general advancing at an accelerated rate, there are sure to be tremendous opportunities for the improvement of wireless power transfer.

There are already some technologies that utilize the approaches mentioned above to create actual wireless charging products. One of these technologies is called Qi, which was introduced by the Wireless Power Consortium. Since the introduction of Qi in 2008, about 20% of mobile phone users have charged their phones wirelessly [1]. Furthermore, big brands like Ikea and McDonald's have installed Qi transmitters in their stores, and mobile phone manufacturers like Samsung have embedded wireless charging into their latest devices. Even Apple has stepped into the realm of wireless charging with its latest product, the Apple Watch. The industrial support behind wireless charging has boosted WPC's development of wireless charging technology, allowing them to work on wirelessly charging mobile devices at an increased rate. WPC is also transitioning to the wireless charging of tablets, which previously demanded too much power for wireless charging to be viable [2]. These improvements cannot come soon enough for consumers, as the demand for wireless charging technology has grown alongside its increasing implementation. Meanwhile, wired charging is widely viewed as burdensome since people have difficulty finding outlets and sometimes need to charge their devices on-the-go multiple times per day [3]. In a society where people now expect their devices to be efficient and convenient to use, wireless power transfer will undoubtedly be improved to satisfy consumers. Ultimately, wireless charging is the frontrunner of many solutions that will bring faster and more powerful charging. Once this technology becomes dominant in the mobile phone industry, its applications in other fields will quickly follow suit.

In the realm of medical technology, researchers and engineers are now developing groundbreaking implantable devices and portable devices which will harness the power of high resonance wireless power transfer. Some implantable devices such as pacemakers and capsule endoscopy will drastically improve the quality of treatment patients receive [4]. By eliminating the need for an invasive operation whenever new batteries are needed, a fully implantable LVAD could improve comfort and safety for a large population of patients. Many patients with heart failure are not good candidates for transplant, and a fully implantable LVAD could serve as a permanent destination therapy, extending and improving their life in a relatively noninvasive manner. Wireless power transfer can also be used with many other portable medical devices that are commonplace in hospitals and doctor's offices. For example, the technology can be used to charge surgical power tools, handheld diagnostic instruments, and portable infusion pumps [5]. Other benefits of wireless power transfer in medical devices include eliminating the need for cords or connect, two of the most failure-prone components in most electronic systems. Since charging cords are eliminated, enclosures can be made watertight, easily sterilizable, and explosion-proof, making devices safer and enabling operation in specialized environments [1]. In comparison to wireless power transfer in the mobile industry, this technology has a much wider range of use in the medical industry. Additional information about electronic and wireless medical devices can be found in our recent publications [6-14].

Wireless power transfer has enabled many devices to be powered or charged safely and efficiently over distance. The benefits of using this technology range from enabling implant architectures that could not otherwise be possible or practical to improving the productivity and safety of both patients and healthcare professionals. By studying theoretical approaches throughout history, engineers and researchers have come up with actual implementations of wireless charging. Not only that, many cell phone devices can currently be powered wirelessly, with more devices in other industries on the way. Similarly, wireless electricity delivered safely and efficiently over distance has the potential to usher in a new generation of medical devices.

References

1. Hartford J (2013) Wireless Power For Medical Devices. MDDI Medical Device and Diagnostic Industry News Products and Suppliers.
2. Barrett B (2015) Everything Standing Between Your Phone and Wireless Charging. WIRED, 2016.
3. Institute of Physics (2007) Wireless Power A Reality. Science Daily, 2016.
4. Cube R (2014) The Tesla Theory: Who Will Win The Race For Wireless Power? Make Use Of, 2014.
5. Gershgorn D (2015) The Wireless Charging Future Is Getting Closer To Reality. Popular Science 2015.
6. Ahuja N, Eshaghian-Wilner MM, Ge Z, Liu R, Nuduru Pati AS, et al. (2016) Wireless Power for Body Devices. Proceedings of 9th Nano Congress for Next Generation, Manchester, UK.
7. Atalla K, Chaudhary A, Eshaghian-Wilner M, Gupta A, Mehta R, et al. (2016) Ethical/Legal Implications of Wireless Health. Proceedings of 13th International Conference on Nanotek and Expo, Arizona, USA.
8. Bhargava A, Cheung J, Lee W, Ravicz K, Schlesinger M, et al. (2016) Status and Modeling of Nanomedicine. Proceedings of 6th Global Experts Meeting & Expo on Nanomaterials and Nanotechnology, Dubai.
9. Bhargava A, Eshaghian-Wilner MM, NuduruPati AS (2016) An Introduction to Wireless Computing in Medicine. In: Wireless Computing in Medicine and Its Ethical/Legal Implications: From Nano to Cloud. Wiley Publishers.
10. Eshaghian-Wilner MM, Ge Z, Liu R (2016) Wireless Power for Medicine. In: Wireless Computing in Medicine and Its Ethical/Legal Implications: From Nano to Cloud. Wiley Publishers.
11. Eshaghian-Wilner MM, Navab S, Sarkar G (2016) From Cloud to Nano Wireless Computing. In: Wireless Computing in Medicine and Its Ethical/Legal Implications: From Nano to Cloud. Wiley Publishers.
12. Bhargava A, Cheung J, Eshaghian-Wilner MM, Lee W, Padala KSR, et al. (2016) Nanotechnology in Medicine. In: Wireless Computing in Medicine and Its Ethical/Legal Implications: From Nano to Cloud. Wiley Publishers.
13. Eshaghian-Wilner MM, Schlesinger M (2016) Concluding Remarks and Future Research in Wireless Computing in Medicine. In: Wireless Computing in Medicine and Its Ethical/Legal Implications: From Nano to Cloud. Wiley publishers.
14. Eshaghian-Wilner MM, Ge C, Liu R, Nuduru Pati AS (2016) Wireless Power for Implantable Devices: A Technical Review. In: Wireless Computing in Medicine and Its Ethical/Legal Implications: From Nano to Cloud. Wiley publishers.