

**ABSTRACT**

In the modern world, we have often heard a word- wireless charging technology. Actually what is it all about? So this paper is giving you the whole package about wireless charging technology. Wireless charging is a technology through which power is transmitted through an air gap to the electrical devices for the motive of replenishment of energy. At present wireless charging techniques and development of commercial products have provided a promise to address the energy bottleneck of portable battery powered devices. The incorporation of wireless charging into existing wireless communication system brings a series of challenges like implementation, scheduling, and power management. The paper presents a detailed view on wireless charging techniques along with its need, invention, advantages, disadvantages and standards. It will also present working of one these technologies. It is a hectic task to carry the charger of mobile phones everywhere or any electronic gadget while travelling and it is very cruel when your mobile phone getting off by the time you urgently need it, so today's world requires the complete technology so here is an overview of existing wireless charging techniques. The paper also discusses about the problems and challenges which takes place while implementing wireless charging technology. In addition it also envisions practical future of wireless charging technology.

**INTRODUCTION**

Wireless charging, is known as wireless power transfer, is the technology that enables a power source to transmit electromagnetic energy to an electrical load across an air gap, without interconnecting cords. This technology is attracting a wide range of application, starting from low power toothbrush to high power electric vehicles because of its convenience and better user experience. Wireless charging provides a suitable, safe, reliable method to charge and power billions of electrical devices at different locations. Eliminating the use of physical connectors and cables, wireless charging provides a number of efficiency, cost and safety advantages over the traditional charging cable.

Nowadays, wireless charging is rapidly evolving from theories toward standard features on commercial products, especially mobile phones and portable smart devices. For instance, in 2014, many leading smart phone manufacturers such as Samsung, Apple and Huawei, began to release new generation devices featured with built-in wireless charging capabilities. IMS Research envisioned that wireless charging would be a 4.5 billion market by 2016. Pike Research estimated that wireless powered products will triple by 2020 to a 15 billion market.

Wireless charging is also known as inductive charging that uses electromagnetic field to transfer energy between two or more objects, which is usually done through charging station.

Compared to traditional charging with cord, wireless charging have many advantages as follows:

- 1.) It improves user-friendliness as the hassle from connecting cables is removed.
- 2.) It renders the design and fabrication of much smaller devices without the attachment of batteries.

Wireless charging incurs higher implementation cost as compared to wired charging.

The development of wireless charging technologies is advancing toward two major directions. First, radiative wireless charging and second, non-radiative wireless charging.

Wireless charging has a lot of scope, and a lot more to develop. Hopefully, with some help from Apple, Google someday we could be walking into café, shops and simply signing in our devices to power hotspot for wireless charging. Just like we use Wi-Fi.

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**PROBLEM FACED WITH WIRED TECHNOLOGY [1]****Device Maintenance-**

The traditional charging process through wires is very tedious as wires get messy. In charging process through wires there is usb ports in devices to connect devices through wires to power supply. These ports in devices increases wear and tear of electronic devices. Furthermore manufacturers are not able to make devices water and dust proof.

**User Experience-**

This factor is most important these days as customer is king of market. People want comfort and charging is real pain-point for users. Charging with wires is real pain for customer as they fit just that specific device. User have to sort the cables of charger every time they want to use it. Wired charging technology reduces the portability of devices.

**CHALLENGES IN WIRELESS TECHNOLOGY**

The idea of sending energy wirelessly came to TESLA in 1890's. The 19<sup>th</sup> century saw many developments in mathematics and counter theories on how electrical energy could be transmitted. Ampere's circuital law show that electric current produces a magnetic field. Faraday law induction of induction describe the electromagnetic force induced in a conductor by time-varying magnetic flux. The main challenges faced by current technology are:

**Performance-**

One of the main reasons that wireless charging has not been fully integrated is that it is slower and less efficient than a traditional charger. Heat generated in some wireless charging technology is generally higher than traditional charging technology.

**Mobility-**

We call it wireless technology but it is necessary to plug the charging station to the wall, to transmit signal between device and charging station.

**Expensive-**

Wireless charging technology is still developing day by day, it also requires drive electronics and coil in both device and charger that increases the complexity and thus cost of manufacturing.

**Inconvenience-**

When electronic devices are connected to wired charging devices, it can be freely moved around and used while charging. But in most wireless charging, the electronic devices must be left on charging station also called charging pad, and thus cannot be moved easily or used while charging.

**LITERATURE SURVEY**

**Wireless Charging Technologies: Fundamentals, Standards, and Network Applications-** Xiao Lu<sup>†</sup>, Ping Wang<sup>‡</sup>, Dusit Niyato<sup>‡</sup>, Dong In Kim<sup>§</sup>, and Zhu Han<sup>†</sup> <sup>†</sup> Department of Electrical and Computer Engineering, University of Alberta, Canada <sup>‡</sup> School of Computer Engineering, Nanyang Technological University, Singapore <sup>§</sup> School of Information and Communication Engineering, Sungkyunkwan University (SKKU), Korea <sup>†</sup> Electrical and Computer Engineering, University of Houston, Texas, USA.,IEEE sensor journal,(2008-2009).

The integration of inductive charging with existing communication networks creates new opportunities as well as challenges for resource allocation. This research has shown the existing solutions of providing seamless wireless power transfer via static charger scheduling, mobile charger dispatch and wireless charger deployment. Among those studies, various other issues including online mobile charger dispatch strategies, schemes for near-field energy beamforming, mobile networks energy provisioning, distributed deployment strategies of wireless charger, and multiple access control for wireless power communication networks are less explored and further investigation is required.

Hadley, Franklin (2007-06-07). "Goodbye wires...". MIT News. Massachusetts Institute of Technology. Retrieved 2007-08-23. the advance online publication of the journal Science.

MIT team experimentally demonstrates inductive.

The team consists Andre Kurs, Aristeidis Karalis, Robert Moffatt, Prof. Peter Fisher, and Prof. John Joannopoulos (Francis Wright Davis Chair and director of ISN), led by Prof. Marin Soljacic.

They realizing their recent theoretical prediction, the team was able to light a 60W light bulb from a power source which is seven feet (more than two meters) away ; no physical connection exist between the source and the appliance. The MIT team refers to its concept as "WiTricity" (as in wireless electricity). The work will be reported in the June 7 issue of Science Express, the advance online publication of the journal Science.

### **Planar Wireless Charging Technology for Portable Electronic Products and Qi**

S. Y. Hui, Fellow IEEE (2009-2010).

The commercialization of mobile phones in the 1980s has significantly sped up the research and development stuff in planar wireless charging systems. In this paper, developments of short-range planar wireless power transfer technologies for portable electronic products have been described. The choice of wireless charging over capacitive charging is explained. The horizontal flux and vertical flux techniques are explained and compared. It is more than essential to design planar inductive charging systems with compliance with a range of international regulations including electromagnetic compatibility and human exposure to electromagnetic fields. user-friendly and safety applications that are more essential to domestic planar wireless charging systems are highlighted and explained. For low power applications up to 5 W, foreign object detection and increased transmission distance will be definitely major challenges in the near future. With the development of the WPC and its launch of the "Qi" wireless power standard, it is envisaged that the "Qi" standard will be expanded to cover more applications of medium power levels (up to 120 W) in order to cover the inductive charging of portable electronic products such as mobiles, ipads and notebook computers. The startup by the WPC to increase transmission distance and power open new gateway for wireless power research and development activities. In theory, planar inductive charging systems can be incorporated into environment of office, coffee and bedside tables, and bathroom and kitchen desktops for powering a wide range of electric devices from low-power devices, such as trimmers and mobiles, to high-power devices, such as inductive-cooking utensils and electric kettles. So, more and more wireless power systems and devices are expected to enter the consumer markets in the near future.

**Short Range Wireless Charging System for Smart Phone through New Energy Harvesting Circuit,** J.Gobinath (Asst Prof), M.Vinoth Kumar (Asst Prof), M.Lenin (P.G Scholar). Department Of IT, Department Of EEE Embedded System & Tech Rajiv Gandhi College of Engg , Rajiv Gandhi College of Engineering, Rajiv Gandhi College of Engg Chennai Chennai Chennai. International Journal of Computer Applications® (IJCA) (0975 – 8887) International Conference on Current Trends in Advanced Computing (ICCTAC).

This research shows that charge energy by using Bluetooth technology. Somehow the amount of charging energy is not enough to use ambient charging technology now, proposed circuit based on Bluetooth technology can improve to capture higher charging energy. It can useful for most of electronic devices like Tablet PC, PDA. the proposed system gives a new charging circuit based on schottky diode with a real commercial film-type antenna on mobile device terminal. New power-charging structures have a charging efficiency approximately by 160%, i.e, 0.45 mA rather than 5 mA for a current Smartphone in the market.

**WIRELESS CHARGING OF MOBILE PHONE USING MICROWAVE** Priya A. Rewaskar, Prof. Dinesh Datar, Computer Science & Engg., SGBAU, Amravati. International Journal of Computer Science and Mobile Computing. IJCSMC, Vol. 3, Issue. 4, April 2014, pg.427 – 432.

In todays scenario mobile phones are becoming a basic part of our life . this is one of the most important medium for the communication for sure, the mobile phone batteries has always been problem for recharging for every individual. Mobile devices have to be put to recharge after the batteries has drained out. In this research the main motive is shown to make the recharging of mobile devices wherever we want without charger this is done only when there is a use of microwave, the microwave signal transmitted from transmitter via special kind of antennas called slotted wave guide antennas at a frequency of 2.45GHZ. We have to add a sensor, rectenna circuit in our mobile phone to do this task successfully. This is surely one of the best technologies and for this task we are proposing wireless charging of mobile phones by using microwaves.

### **WORKING OF WIRELESS CHARGING TECHNOLOGY**

Wireless charging is based on principle of magnetic resonance or Inductive Power Transfer(IPT). Wireless charging also known as inductive charging uses an electromagnetic field to transfer energy between two objects through electromagnetic induction. This is conventionally done with a charging pad also called charging station. Energy is sent through an inductive coupling to an electronic device, which can then use that energy to charge batteries of electronic devices.

Induction chargers use an induction coil to create an alternating electromagnetic field from within a charging station, and a second induction coil in the portable device takes power from electromagnetic field and converts it back into electric current to charge the battery. The two induction coils in proximity combine to form an electrical transformer. Most wireless chargers only operate over a short distance, however, and while physical contact between a electronic device and its charging station isn't necessary for induction to work but the field generated is very weak and device must be in direct contact of charging station.

#### Steps of Wireless charging-

1. Main voltage is converted into high frequency alternating current.
2. The alternating current is sent to the transmitter coil by the transmitter circuit. The AC current then induces a time varying magnetic field.
3. The AC current flowing within the transmitter coil creates magnetic field which extends to the receiver coil within specified distance.
4. The magnetic field generates current within the receiver coil of electronic devices.
5. Current flowing within the receiver coil is converted into DC current by receiver and thus charging the battery.

As for safety, there's really nothing to worry about. The average wireless charging system creates a field no more dangerous than radio waves, and waves are not strong enough to have any effect on human body.

#### RESONANT INDUCTION COUPLING-

Resonant induction coupling is an effect that allowed inventors to safely transmit power or energy to several meters. Inductive Power Transfer (as overriding principle) uses resonance in order to achieve coupling of the transmitter and receiver coil, achieved when both coil oscillate with same frequency.

#### ADVANTAGES

- Connections are protected – No chance of corrosion when the electronics are all enclosed, away from water or oxygen in the atmosphere. No tension of electrical faults like short circuit because of insulation failure, majorly where connections are made or broken frequently.
- Infection risk is low – For embedded medical devices, transmission of power through a magnetic field passing through the skin ignores the infection risks associated with wires penetrating the skin.
- Durable – No need to constantly plug and unplug the device, there is basically less wear and tear on the socket of the device and the attaching cable.
- Convenience and aesthetic quality increased – avoid cables.

#### DISADVANTAGES

- Slow charging rate – Because of the lower efficiency, devices take more time to charge even when supplied power is the same amount.
- Expensive – Wireless charging also requires drive electronics and coils in both device and charger, therefore complexity and cost of manufacturing are getting increased.
- Create inconvenience - When electronic devices is connected to a cable, it can allow to move freely around and operated while charging. In most implementations of wireless charging, the electronic devices must be left on a pad to charge, and thus can't be easily operated while charging.

Newer techniques reduce transfer losses via ultra-thin coils, higher frequencies, and optimized drive electronics. Due to this more efficient and compact chargers and receivers, providing their integration into mobile phones or batteries with less changes required. These technologies provide charging times comparable to wired techniques, and they are constantly finding their way into mobile devices.

#### FUTURE SCOPE

Technology is reaching new heights in modern world. Study of science helps to develop technology for user friendly uses. Wireless charging too has future scope and can evolve to a great extent. For instance electric buses in South Korea can now be charged through a wireless platforms, new line of furniture that includes lamps, tables with built-in charging stations.

Newer approaches reduce transfer losses through the use of ultra-thin coils, higher frequencies and optimized electronics devices. This will result in high efficiency and compactness of devices.

Some companies are already designing systems in which wireless charging platforms in hotel rooms will be able to not only charge phones, but also figure out when people are in their room, sync their TV to the last spot in movie.

### SCOPE IN FIELD OF: MEDICAL DEVICES AND EQUIPMENT-

Induction charging has a very important role to play in the future of medicine and medical care. Nowadays even the most basic of medical procedures needs advanced range of medical equipment. Equipment that are powered largely via battery packs or main supply. Wireless charging can help to reduce source of contamination but also reduces physical hazard.

### Vehicles -

Wireless charging of electric vehicles continue to be one of the most researched are of wireless power transfer. With wireless charging, charging of vehicles can be done whether parked or moving, thus allowing convenient charging experience to user.

### CONCLUSION

Wireless charging technology offers the possibility of eradicating the last remaining cord connections required to charge portable electronic devices. This wonderful technology has significantly advanced during the past few decades and brings a large amount of user-friendly applications. In this article, we have given a comprehensive view on the paradigm of wireless charging technology. Starting from the development history, need, previously existing research regarding this technology, problems which we were facing before this, along with challenges faced while implementation and we also added working of one of the wireless charging technologies, further introduced the advantages and disadvantages of wireless charging along with practical future scope particularly in medical devices and equipment and vehicles. On the whole this survey has shown that how much wireless charging is efficient and surely can be more effective in near future.

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