

White Paper: Reflections and Analysis from Sentec

CHARGE! THE RACE FOR WIRELESS POWER

Charging devices 'wirelessly', ie without direct contact between charging module and power system, is an idea which has been floating around the consumer electronics market for several years now, but in 2008 it has suddenly sparked a surge of interest. New entrants to the market such as Splashpower, e-Coupled and Wildcharge are rolling out their first products and reference designs, while established players including Motorola, Apple and Seiko Epson are rumoured to be developing their own solutions.

Meanwhile, the popular press was excited last year by the announcement from researchers at MIT that they have discovered a way of using resonance to supply power wirelessly directly to devices without the intermediate step of charging a battery.

However, this is a technology that poses some significant technical challenges and products are still thin on the ground. With several years of experience in the area, Sentec is becoming adept at tackling these challenges to bring wireless charging one step closer to the market.

MARKET MEETS TECHNOLOGIES

Although all the science needed to enable wireless charging has existed for over 150 years, the sudden rush to wireless is being driven by the meeting of market and technology. The huge growth in portable devices such as mobile phones, MP3 players and digital cameras has made the time and hassle of recharging an increasing issue for consumers. These comparatively low power devices are suitable for wireless recharging and electromagnetic induction technologies have now breached the threshold of power efficiency considered to be the minimum at which the solution becomes feasible for such devices.

At the same time, battery development is slowing down with only incremental improvements in size, weight or lifespan. This means consumers will have to work with existing recharging routines for some years to come, particularly as portable fuel cells, the next generation of power solutions, are at least a few years off.

In this technology gap the investment in wireless recharging makes sense, as it offers an opportunity to reduce the hassle factor of recharging for consumers, and provides manufacturers with strategies for increasing brand lock-in and differentiation. The technology offers a different package of benefits to consumers and manufacturers:

BENEFITS TO CONSUMERS

- One to many charging reduces number of wires and space required
- Reduces inconvenience of carrying several weighty chargers if travelling
- Reduces environmental impact of large number of charging devices
- Reduces chances of user error in charging (camera not in cradle correctly or charger not switched on)
- Improves product lifetime by removing point of failure at connectors

BENEFITS TO MANUFACTURERS

- Reinforces innovative brand image
- Provides opportunity for increasing loyalty to brand across different product classes
- Reduces design overhead by providing one common charger design for many products
- Removes connectors and therefore reduces product failure
- Potential for simultaneous power and data transfer

Once the number of power cables are reduced, the same logic suggests that reducing or removing data cabling is attractive. There are, of course, a number of techniques for wireless data transfer, which raises the interesting prospect of products requiring no external connections.

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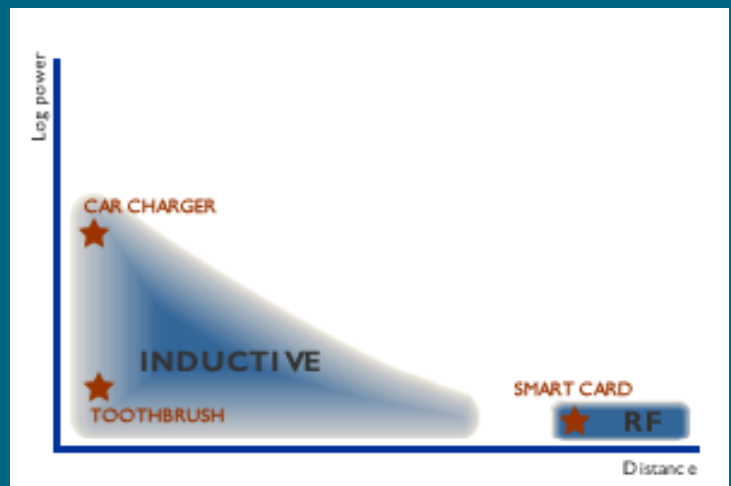


Above: first generation inductive charger

TECHNIQUES AND APPLICATIONS

Historically, commercial applications of 'wireless power' techniques have grouped themselves around three broad techniques: inductive charging (electromagnetic induction), 'trickle' charging from radio waves and electromagnetic resonance.

These are rather arbitrary distinctions, however, as they are all points on a continuum of electromagnetic energy transfer, which is constrained by factors of distance between source and device, size of device and power being transferred:



TECHNIQUES AND APPLICATIONS

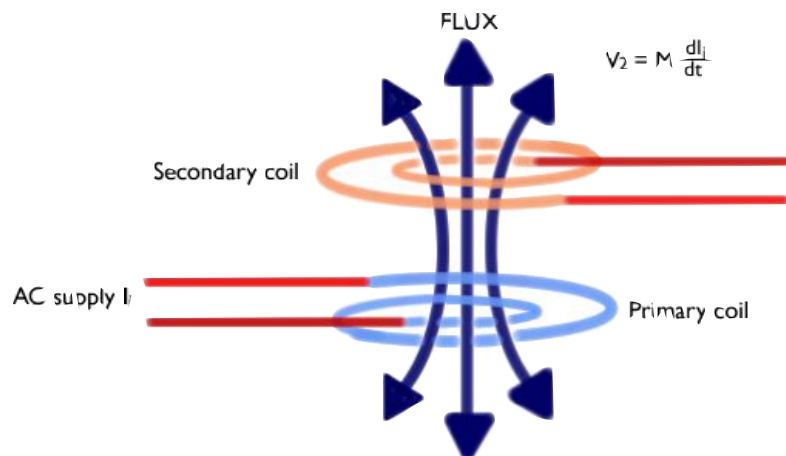
There is no theoretical reason why any level of power cannot be transferred across any distance to any size of device, but of course engineering solutions that provide acceptable levels of cost, safety and useability are easier in some areas than others.

Consequently, in this spectrum of solutions, the non-contact technology which is achieving the most widespread adoption in the consumer electronics market is electromagnetic induction, where two coils are placed close to each other. When current passes through one, the generated magnetic flux causes electromotive force to be generated in the other. This technique is capable of transmitting hundreds of watts of power across very small distances (a few mm) which makes it appropriate for rapid charging of mobile devices in one location. At a greater distance, say a few cm, the practical limit drops to a few watts.

Other solutions that are commercially available include RF 'trickle charging' which uses radio waves to transmit and receive energy directly. This is a technology that has been known for over a hundred years, for example where AC radio waves are converted into DC without amplification in a crystal, but recent improvements in efficiency based on smart card recharging techniques have made it possible to consider this technology for other commercial applications.

State of the art regimes in this area are able to handle ranges of up to about 10m, but only for power levels of several mW to several hundred mW, meaning they are most suitable for stand-by power.

However, they offer the prospect of truly wireless recharging, where any device in a room will receive a trickle of power and will eventually recharge with no intervention from its owner.



SENTEC AND WIRELESS RECHARGING

With deep expertise and over 10 years of experience in magnetics, RFID and power supplies, it is not surprising that Sentec has developed many solutions in this area and that of simultaneous data transfer.

Our experience in solving common problems such as efficiency (and related heat generation issues), interference and freedom of positioning is helping drive forward new products in this area and as the applications become better understood, we believe the market for wireless charging can only expand.

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