# Battery anxiety

Our continued reliance on mobile devices means that users are keen to keep their devices always on and charged. By **Bethan Grylls**

As mobile devices become more capable the more power hungry they become, yet the research that has been undertaken into extending the capabilities of battery technology seems to have reached its limit.

The term 'battery anxiety' was coined by LG last year, following a survey it conducted on mobile charging habits, that revealed 90% of respondents suffer with this modern 'ailment'.

Portable, wireless charging seems the obvious remedy but while there has been a surge in research into this technology and, according to the Wireless Power Consortium (WPC), there has been an increased uptake in wireless charger users, there remains a number of problems in the widespread adoption of this solution.

Nedko Ivanov, CEO of Metaboards, a metamaterials start-up currently developing technology in the wireless charging field, acknowledges the potential of the wireless charging market, but suggests that there are a number of challenges preventing it from being widely adopted.

The problem, according to Ivanov, is the user experience – by this he means not just how the device charges, but where charging is available.

"To date wireless charging has been little more than a gimmick," according to Ivanov. "A lot of the wireless charging solutions available require the user to place a device directly in alignment with a wireless charger. But, as every wireless charger needs its own unique power supply, users will still effectively have to rely on being close to a cable. So why use wireless charging at all?

"Imagine going into a coffee shop and being able to place your device on a table and know it will be charging, even if there are others also charging their devices on the same surface," Ivanov muses.

"And with no need to line it up perfectly or for you to carry your own personal wireless charger," he adds.

LG's survey on charging habits mirrored Ivanov's thoughts, pointing out that among the consumers it had questioned, around 1,600 across the UK, US, Germany and China, there were "high levels of interest in seeing wireless charging beyond the home and car".

"This is the world we are trying to create at Metaboards," Ivanov explains. The metamaterials company has developed a patented prototype that enables wireless charging through any surface (apart from metal) without the need to directly align two devices. It can also charge multiple devices on one surface from one power source."

Ivanov suggests that the state of wireless charging is evolving in much the same way as that seen when the modem was replaced by Wi-Fi. "While the modem and Wi-Fi offered the same solution, there was a difference in how the technology worked," he explains.

Metaboard surfaces can be used in an array of different enviroments including cafes, offices and in the home

"Wireless charging is at the 'modem stage', we want to bring it to the 'Wi-Fi stage'."

**Qi vs. Airfuel**

Currently, there are two global wireless charging standard bodies:

- The Wireless Power Consortium (WPC) and the
- Alliance for Wireless Power (A4WP).

WPC operates the Qi certification, while A4WP is responsible for Airfuel. Although both are accepted wireless charging standards, they work in slightly different ways.

Qi is the standard for inductive charging and is found in most mobile phones. "It is based upon a one-to-one relationship with the charger and the device, relying on precise alignment," says Ivanov.

Airfuel differs in terms of how it charges and how many devices it can charge, and this is achieved through resonant and RF technology.

It also operates in a higher frequency than Qi.

Resonate charging enables greater spatial freedom, as well as the ability to charge multiple devices at once.

Moreover, it lets the user charge devices through a range of materials including wood and stone. Whereas the RF charging technology provides low power to devices from a distance (up to a metre).

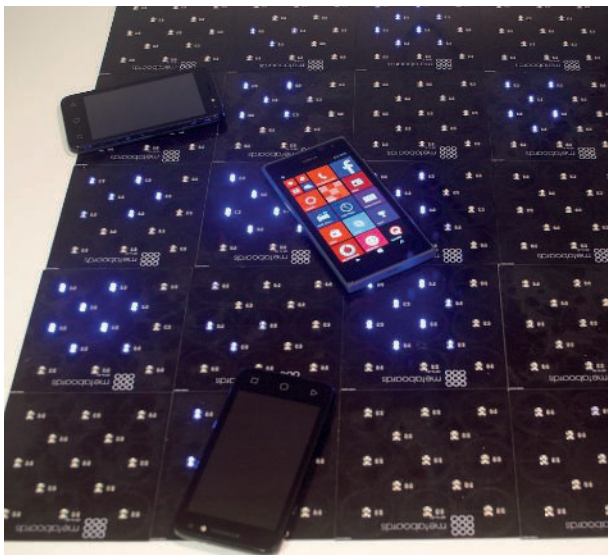
Qi is the standard found in most mobiles because it's easily integrated into mobile devices and a more affordable option than Airfuel, explains Ivanov. Despite its popularity, he believes that Qi has prevented significant progress in terms of wireless charging.

According to Ivanov, Airfuel is the future and "we will see more OEMs switching back to this technology". However, he identifies one key issue with the standard. "The surface is one big coil, emitting an electromagnetic field everywhere. You don't want an electromagnetic field where it doesn't need to be because it can damage a device.

"Moreover, Airfuel is restricted in terms of dimension, with a maximum surface size of A3.

"In our first product, a metaboard (surface) consisted of an array of coupled resonators, responsible for generating a dynamic magnetic field and other components to implement control.

"Such a system is a metamaterial environment, where waves of inter-element excitation can carry power and data," says Ivanov. "In terms of our current solution, each resonator is formed from a spiral printed inductor and tuned to a specific frequency using appropriate capacitors. One of the resonators is designated to be the 'driver' and it is fed power at the chosen frequency. The power is coupled around the board by implementing a number of control mechanisms."



Metaboards has developed a full surface charger out of metamaterials that is able to charge many devices at one time

He continues, "When a load, such as a mobile phone in need of charging, is placed on the surface, a software-based algorithm is used to direct power/flux to that load and is able to minimise flux where it is not needed.

"Crucially, one or multiple devices can be charged anywhere on a metaboard simultaneously without the need for device alignment."

### Creating a surface

To create this 'surface', Metaboards built its own set of development and simulation tools to solve problems such as how to control power flow and design coils with the right characteristics.

"Integrating all the desired features into one product is not a straightforward task and some of the features or principles of their implementation can contradict each other.

"A good example of that is the compromise between efficiency of wireless power transfer and the maximised area coverage of a large charging surface," admits Ivanov.

But he remains confident in the solution, pointing out that the difficulties associated with it, and the solutions Metaboards has come up with, are why "it's not been done before".

Once the environmental conditions are known – the thickness of the table, the material used, etc. – the design can be tailored accordingly to maximise the performance, suggests Ivanov.

"In our current implementation all the electronic components are populated on the underside of the surface. The top (power transfer side) of the surface comprises printed components only so the surface is essentially planar. This makes it ideal for retrofitting/integrating on the underside of tables and bars etc., or as a separate product.

"It is also possible to make it non-planar/conformal to other surfaces."

The surfaces themselves are made using the same standard production materials and processes that are used in other consumer products, so there are no additional costs associated with using custom manufacturing processes and exotic materials.

Ivanov points to the consumer market as the company's core audience, explaining that once the technology is ready for commercialisation other verticals could be explored.

"The main aim is actually to license the concept," says Ivanov. "To do that, we need to create the proof and give confidence to others."

For now, Ivanov says Metaboards is designed to be integrated into surfaces such as tables or into walls, whether in commercial premises or in the home.

But, he also sees potential in the flexible electronics market too, suggesting the technology could one day be woven into fabrics.

**"Imagine if a coffee shop table could just charge multiple mobile devices - without the need for alignment. That's the world we're creating."**
Nedko Ivanov