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Micro-windmills could power your cellphone

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Researchers at the University of Texas at Arlington have designed a micro-windmill that generates wind energy and may become an innovative solution to cell phone batteries constantly in need of recharging and home energy generation where large windmills are not preferred.

Smitha Rao and J C Chiao designed and built the device that is about 1.8 mm at its widest point. A single grain of rice could hold about 10 of these tiny windmills. Hundreds of the windmills could be embedded in a sleeve for a cellphone.

Wind, created by waving the cellphone in air or holding it up to an open window on a windy day, would generate the electricity that could be collected by the cellphone's battery.

Rao's designs blend origami concepts into conventional wafer-scale semiconductor device layouts so complex 3-D moveable mechanical structures can be self-assembled from two-dimensional metal pieces utilising planar multilayer electroplating techniques that have been optimized by WinMEMS Technologies Co., the Taiwanese fabrication foundry that took an initial interest in Rao's work.

"The micro-windmills work well because the metal alloy is flexible and Smitha's design follows minimalism for functionality." Chiao said. These inventions are essential to build micro-robots that can be used as surgical tools, sensing machines to explore disaster zones or manufacturing tools to assemble micro-machines.

The micro windmills were tested successfully in September 2013 in Chiao's lab. The windmills operate under strong artificial winds without any fracture in the material because of the durable nickel alloy and smart aerodynamic design.

"The problem most designers have is that materials are too brittle," Rao said. "With the nickel alloy, we don't have that same issue. They're very, very durable." The micro-windmills can be made in an array using the batch processes.

The fabrication cost of making one device is the same as making hundreds or thousands on a single wafer, which enables for mass production of very inexpensive systems.

"Imagine that they can be cheaply made on the surfaces of portable electronics," Chiao said, "so you can place them on a sleeve for your smart phone.

When the phone is out of battery power, all you need to do is to put on the sleeve, wave the phone in the air for a few minutes and you can use the phone again."

Chiao said because of the small sizes, flat panels with thousand of windmills could be made and mounted on the walls of houses or building to harvest energy for lighting, security or environmental sensing and wireless communication.