Wind turbines less than 2mm. Wow.

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A University of Texas at Arlington (UTA) research associate and electrical engineering professor have designed a micro-wind turbine that generates electrical energy. Their target looks to be an innovative solution to cell phone batteries constantly in need of recharging and home energy generation where large wind turbines are not possible.

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 wind turbines. Their example is hundreds of the wind turbines could be embedded in a sleeve for a cell phone. Wind, created by waving the cell phone in the air or holding it up to an open window on a windy day, would generate the electricity that could be collected by the cell phone's battery.
Rao's work in micro-robotic devices has initially spun up a Taiwanese company's interest in having Rao and Chiao brainstorm over novel device designs and applications for the company's unique fabrication techniques, which are known in the semiconductor industry for their reliability.

Rao said, "The Company was quite surprised with the micro-wind turbine idea when we showed the demo video of working devices. It was something completely out of the blue for them and their investors."
Rao's designs blend origami concepts into conventional wafer-scale semiconductor device layouts of complex 3-D moveable mechanical structures that can be self-assembled from two-dimensional metal pieces utilizing planar multilayer electroplating techniques. The techniques have been optimized by WinMEMS Technologies Co., the Taiwanese fabrication foundry that has taken an initial interest in Rao's work.
Chiao said, "The micro turbines work well because the metal alloy is flexible and Smitha's design follows minimalism for functionality."
WinMEMS became interested in the micro-electro mechanical system research and started a relationship with UTA. Company representatives visited with the UTA team several times in 2013 to discuss collaboration.
An agreement has been established for UTA to hold the intellectual properties while WinMEMS explores the commercialization opportunities. UTA has applied for a provisional patent.
Currently, WinMEMS has been showcasing UTA's works on its website and in public presentations, which include the micro wind turbines, gears, inductors, pop-up switches and grippers. All of those parts are as tiny as a fraction of the diameter of a human hair.
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.
"It's very gratifying to first be noticed by an international company and second to work on something like this where you can see immediately how it might be used," said Rao, who earned her Ph.D in 2009 at UTA. "However, I think we've only scratched the surface on how these micro-wind turbines might be used."
The micro wind turbines were tested successfully in September 2013 in Chiao's lab. The wind turbines operate under strong artificial winds without any fracture in the material because of the durable nickel alloy and smart aerodynamic design.

Smitha Rao at UTA.
"The problem most MEMS 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 wind turbines can be made in an array using batch processing. The fabrication cost of making one device is the same as making hundreds or thousands on a single wafer, which enables 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 thousands of wind turbines could be made and mounted on the walls of houses or building to harvest energy for lighting, security or environmental sensing and wireless communication.
He added that it has been fulfilling to see his former student succeed and help move innovation toward the marketplace.
"To see a company recognize that and seek you out for your expertise speaks volumes about what UTA means to

the world," he said proudly.

A couple things stand out in a big way. First up is the innovation and creativity of blending the Japanese art of origami into real, albeit tiny structures and produce worthwhile products that may well be made by the millions or even billions.

The other striking thing is Professor Chiao presenting the credit to Ms Rao in such a transparent and inclusive way. That level of forthright honesty is a refreshing event and this humble writer is as proud of the good professor as he is of his associate. Hopefully the world's best and brightest will take note of the UTA and Professor Chiao. It's an example of the distinguished dignity and human nature of the finest points of human character.

With commercial interest already at work we're very likely to see products of some kind source from this idea and its execution.

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