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Big ideas for tiny windmills at UTA

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Millions of tiny windmills could one day power wireless sensors that detect cracks in bridges, failures in security systems and dryness in soils -- all thanks to two University of Texas at Arlington research scientists who were inspired by a little girl's pinwheel. Electrical engineering professor J.C. Chiao and associate researcher Smitha Rao designed the 1.8 millimeter by 2 millimeter micro windmills that are so small 10 would fit on a grain of rice. The aerodynamic windmills are made of a durable and flexible nickel alloy.

"My heart stopped beating," Chiao said of the first time the team's tiny windmills were tested.

Although several media outlets have reported that the tiny windmills could be used to charge smartphones, Chiao said portable electronics is only one area where they could be useful.

Because companies already craft all types of charging devices for cellphones, he said he would like to see the tiny windmills used where energy is needed the most, such as powering wireless sensors located in places where making repairs might be problematic.

An example would be the wireless sensors that monitor bridge conditions. Changing out the batteries on the sensors would be costly and labor intensive. But thousands, or even millions, of windmill-powered sensors could do the job.

"We deploy the wireless sensors in those places and continuously monitor that structure's health. That determines if the bridges and highways should be replaced or repaired and saves us quite a bit of money in the future," Chiao said.

The tiny windmills could power remote sensors that monitor soil dryness in fields, saving water, energy and the environment, he said.

The tiny 3-D structures are built from layers of nickel alloy, and include curved blades that can tolerate small to large amounts of wind. So far, they have withstood a leaf blower.

UTA has a patent pending on the devices; therefore Chiao said he cannot yet say how much energy the devices produce.

"We still need to tweak the design. The first design was based off our intuition, now we need to go back to the drawing board," Rao said.

Chiao's former college classmate, CEO of the Taiwanese foundry company WinMEMS Technologies Co., tracked him down in 2012 after stumbling across the work of fellow researcher Rao. After looking into the devices the company made, Chiao and Rao

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agreed to partner with them.

After watching her 3-year-old daughter Isha play with a pinwheel one day, Rao realized that the origamilike design could work for a tiny windmill.

"Smitha got involved because she has a lot of creative ideas," Chiao said. "She continues to generate creative, crazy ideas, and I love them. She can assemble things in her mind."

WinMEMS will work on the commercial aspect of the partnership.

"We still need to evaluate what kind of company we would work with. I hate to rush it. We need to find a good partner," he said. "At the same time we are talking to quite a lot of companies from the U.S., Germany, China, Taiwan and Korea."

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