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New design makes treadmill more like running outdoors

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Steven Devor, front, discusses the new automated treadmill with doctoral student Rich LaFountain. Credit: Photo by Jo McCulty, Courtesy of Ohio State University

Exercise researchers have developed a new treadmill that automatically changes speed to match the pace of the runner.

The automated treadmill uses sonar to tell exactly where the runner is on the treadmill. If the runner picks up pace and moves toward the front of the running belt, the speed automatically increases. If the runner slows down and moves toward the back, the speed decreases.

The result is a treadmill experience that is much closer to walking or running outdoors, said Steven T. Devor, associate professor of kinesiology at The Ohio State University.

"If you're running outside and you want to speed up or slow down, there is no button to push. It is the same with this new automated treadmill," Devor said.

"It is seamless and feels completely natural. You just go."

Devor developed the new automated treadmill with Cory Scheadler, a former graduate student at Ohio State who is now an assistant professor at Northern Kentucky University.

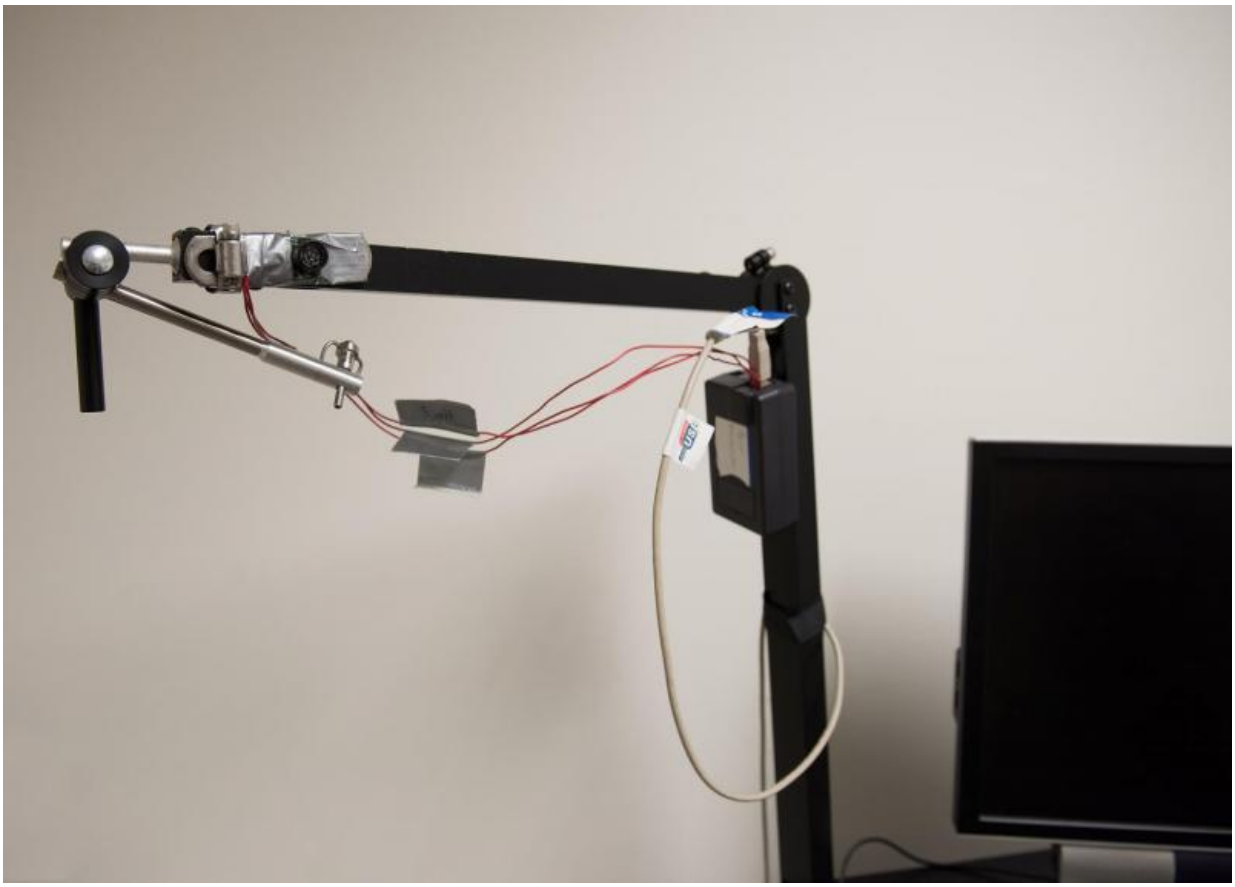
The researchers revealed the automated treadmill in a study published online in the journal *Medicine & Science in Sports and Exercise*.

Devor said the device is a finished prototype in his lab and is nearly ready for commercialization. As an incentive for a fitness equipment manufacturer to make the investment necessary to turn the automated treadmill into a product ready for use at fitness clubs, Ohio State recently filed a patent application covering the treadmill's novel features.

Devor said the potential upside of the automated treadmill for athletes and anyone that uses a treadmill in a gym is obvious. When running or

walking outside, people naturally speed up and slow down all the time without doing it consciously. But with a regular treadmill, you have to manually adjust every change in speed.

"So many people call it the 'dreadmill.' It is boring and monotonous. An automated treadmill makes the experience much more natural and you can just run without thinking of what pace you want to set," he said.



This sonar device is placed behind the treadmill to measure where the runner is on the running belt. Credit: Photo by Jo McCulty, Courtesy of Ohio State University

The researchers developed the new setup using off-the-shelf products. They started with an inexpensive sonar range finder, which is used to measure the distance between an object and the sonar device. They attached it to a microcontroller and a computer, which was linked to the electronics in the treadmill.

The sonar is set up behind the treadmill and aimed at the runner's back, just between the shoulder blades.

When the runner is in the middle of the running belt (measured from front to back), the speed of the treadmill stays the same. If the sonar senses that the runner is moving farther away, that means the runner is picking up speed and the sonar microcontroller sends a signal to the treadmill to speed up the belt in varying increments of speed. The speed increases until the runner returns to the middle of the belt.

If the sonar senses the runner is getting closer to the device, a signal tells the treadmill to slow down until the runner returns to the middle.

"It is all seamless and the runner doesn't even know that it's happening," Devor said.

Development of the prototype took a lot of trial and error before the researchers got all the parts to work together flawlessly. In early versions, the belt would speed up and slow down unpredictably. But now it works smoothly and reacts very quickly - so quickly that Scheadler, an elite runner, could break into a fast sprint on the automated treadmill and still not hit the front of the device, Devor said.

While the automated treadmill has a high potential future in the nation's fitness clubs, the article in Medicine & Science in Sports & Exercise documents its immediate value for exercise researchers.

Devor and Scheadler found that the automated treadmill did a better job than standard treadmills at providing an accurate measure of an athlete's aerobic capacity.

Most elite athletes - and increasingly many regular exercisers - have had their aerobic capacity measured through maximal oxygen consumption (or VO2 max) tests.

These tests, often done on treadmills, measure the maximum volume of oxygen that an athlete can use. The tests involve athletes pushing themselves to exhaustion in a treadmill test while wearing a mask that measures oxygen use.

In this study, the researchers had 13 experienced endurance runners take a VO2 max test using both a standard treadmill and the automated treadmill. Results showed that the athletes improved their VO2 max scores by 4 to 7 percent using the automated treadmill.

That's important, Devor said, because VO2 max scores are vital when developing heart rate training zones. These heart rate zones guide exercisers in using the right amount of effort when they are in training.

"If you have a more accurate VO2 max score, your heart rate zones are more accurate and your training will be more effective," he said.

Devor said he is continuing to improve the automated treadmill and use it for research. He's not sure when it will be ready to commercialize, but he is excited about the prospects.

"I think this automated treadmill would be appealing to anyone who has ever called it a 'dreadmill.'"