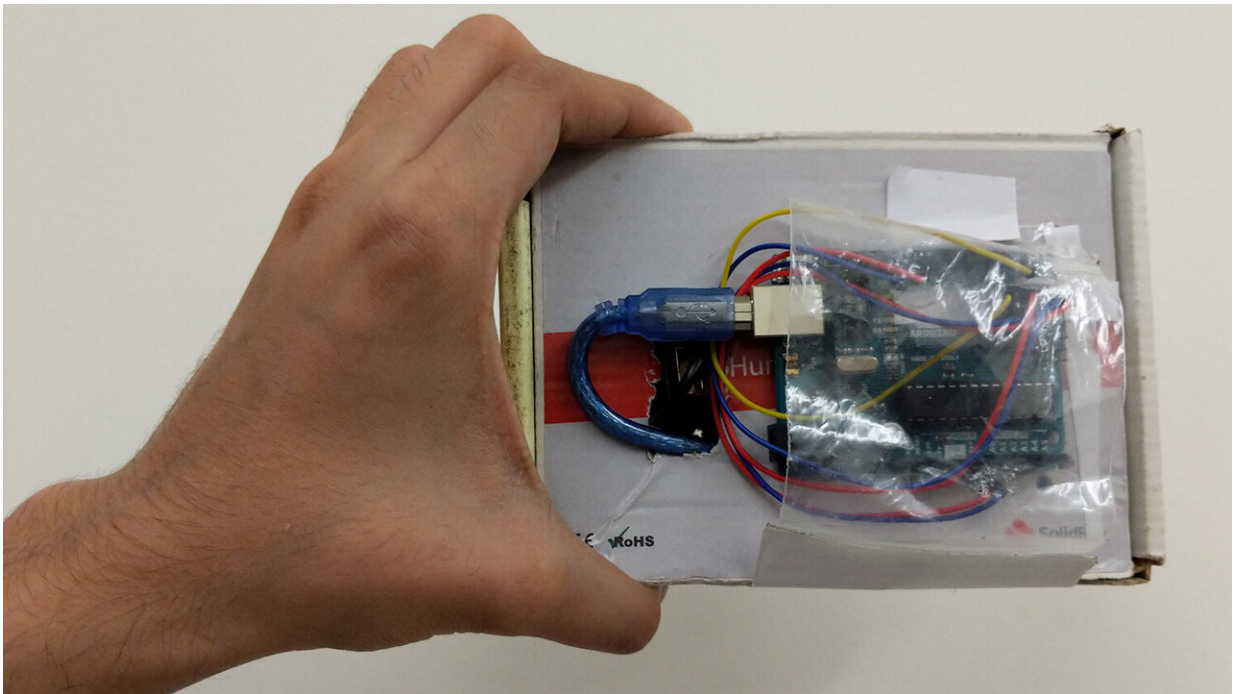


Using Wi-Fi-like sonar to measure speed and distance of indoor movement

August 27 2019, by Matt Shipman



WIO is a software program, but researchers created a hardware prototype for initial testing with other devices. Credit: North Carolina State University

Researchers from North Carolina State University have developed a technique for measuring speed and distance in indoor environments, which could be used to improve navigation technologies for robots, drones—or pedestrians trying to find their way around an airport. The technique uses a novel combination of Wi-Fi signals and accelerometer

technology to track devices in near-real time.

"We call our approach Wi-Fi-assisted Inertial Odometry (WIO)," says Raghav Venkatnarayan, co-corresponding author of a paper on the work and a Ph.D. student at NC State. "WIO uses Wi-Fi as a velocity sensor to accurately track how far something has moved. Think of it as sonar, but using radio waves, rather than sound waves."

Many devices, such as smartphones, incorporate technology called inertial measurement units (IMUs) to calculate how far a [device](#) has moved. However, IMUs suffer from large drift errors, meaning that even minor inaccuracies can quickly become exaggerated.

In outdoor environments, many devices use GPS to correct their IMUs. But this doesn't work in indoor areas, where GPS signals are unreliable or nonexistent.

"We created WIO to work in conjunction with a device's IMU, correcting any errors and improving the accuracy of speed and distance calculations," says Muhammad Shahzad, co-corresponding author of the paper and an assistant professor of computer science at NC State. "This improvement in accuracy should also improve the calculations regarding a device's precise location in any indoor environment where there is a Wi-Fi signal."

The researchers wanted to test the WIO software but ran into a problem: they could not access the Wi-Fi network interface cards in off-the-shelf devices such as smartphones or drones. To address the problem, the researchers created a prototype device that could be used in conjunction with other devices.

The researchers found that using WIO improved a device's speed and distance calculations dramatically. For example, devices using WIO

calculated distance with a margin of error ranging from 5.9% to 10.5%. Without WIO, the devices calculated distance with a margin of error from 40% to 49%.

"We envision WIO as having applications in everything from indoor navigational tools to fitness tracking to interactive gaming," Venkatnarayan says.

"We are currently working with Sony to further improve WIO's accuracy, with an eye toward incorporating the software into off-the-shelf technologies," says Shahzad.

The paper, "Enhancing Indoor Inertial Odometry with WiFi," will be presented at UbiComp 2019, being held from Sept. 11-13 in London, U.K.

More information: Raghav H. Venkatnarayan et al. Enhancing Indoor Inertial Odometry with WiFi, *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* (2019). [DOI: 10.1145/3328918](https://doi.org/10.1145/3328918)

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