

Otago-led research set to make smartphones even smarter

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Dr Robert Odolinski, configuring a smartphone to collect multi-GNSS data.
Credit: University of Otago

The accuracy of the global positioning system (GPS) in smartphones has been significantly improved thanks to research conducted at the University of Otago, New Zealand, in collaboration with Curtin University, Australia.

Have you ever noticed that the GPS location on your [smartphone](#) isn't all that smart? For example, your smartphone claims you are in the duck pond when in fact you are on the other side of the park and can't even see the duck pond? This new research conducted at the University of Otago, and recently published in the international Journal of Geodesy, is about to change that.

By combining signals from four different Global Navigation Satellite Systems (GNSSs), Otago's Dr. Robert Odolinski and Curtin University colleague Prof Peter Teunissen, have demonstrated that it is possible to achieve centimeter(cm)-level precise positioning on a smartphone.

"It's all down to the mathematics we applied to make the most of the relatively low-cost technology smartphones use to receive GNSS signals, combining data from American, Chinese, Japanese, and European GNSS. We believe this new capability will revolutionize applications that require cm-level positioning," Dr. Odolinski says.

He says to understand the new technology, a look back at the historical scientific context is needed.

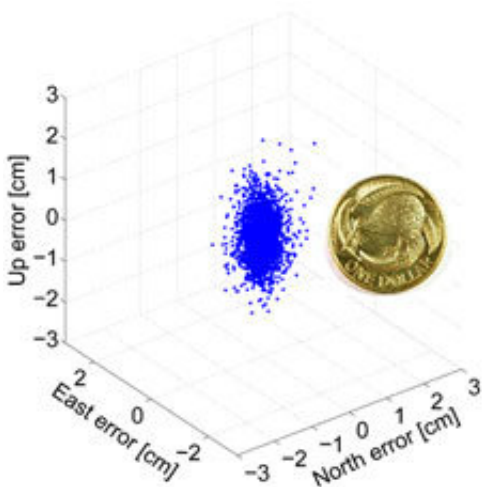


Figure 1. Precise centimetre-level positioning on a smartphone during 24 hours

in Dunedin, New Zealand. Blue dots show repeatability of one epoch data in comparison to precise benchmark coordinates. The repeatability is more or less the size of a one dollar New Zealand coin (diameter of 2.3 cm) in all three dimensions. Credit: University of Otago

"For decades, construction, engineering, cadastral surveying and earthquake monitoring have relied on high-cost, 'dual-frequency', GPS positioning to obtain centimetre-level location information. The challenge is that GPS signals, travelling from Earth-orbiting satellites to receivers on the ground, are disrupted along the way, and this generates errors and limiting precision. The traditional solution is to combine GPS signals sent at two different frequencies to improve the positions, but the antennas and receivers required have been expensive, far beyond the reach of many who would benefit from the technology," says Dr. Odolinski.

The new approach uses only one of two frequencies but collects data from more satellites, for what is called a "multi-constellation" GNSS solution. The extra data (and clever maths) is used to improve the positions without adding cost.

What Dr. Odolinski and Prof Teunissen have now shown is that this approach can work in smartphones too, producing competitive results compared to dual-frequency GPS solutions (Figure 1).

Dr. Odolinski believes that countries and industries of all sizes can benefit from using smartphones as GNSS receivers, and is confident commercial application and development will lead on from this research.

"This significant reduction in costs when using smartphones can increase the number of receivers that can be deployed, which will revolutionize a

range of disciplines requiring centimetre-level positioning, including precise car navigation, surveying, and geophysics (deformation monitoring), to name a few."

More information: Robert Odolinski et al. An assessment of smartphone and low-cost multi-GNSS single-frequency RTK positioning for low, medium and high ionospheric disturbance periods, *Journal of Geodesy* (2018). [DOI: 10.1007/s00190-018-1192-5](https://doi.org/10.1007/s00190-018-1192-5)

Provided by University of Otago

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