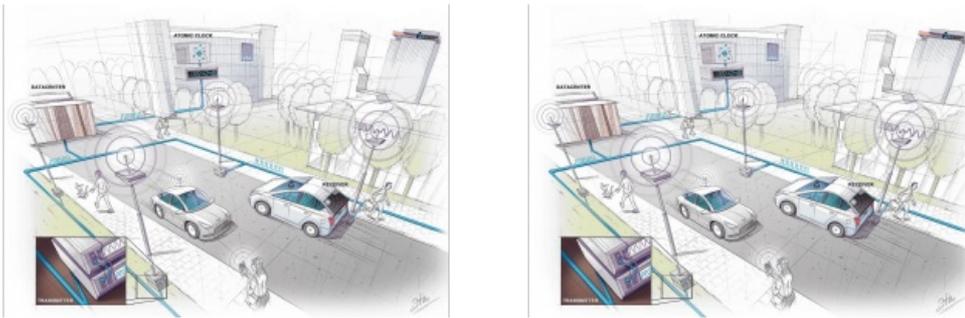


Dutch Scientists Develop a More Accurate and Robust Alternative to GPS



Scientists in the Netherlands have developed an alternative navigation system with 10cm accuracy. The system, which was implemented in a specially developed mobile network, offers a glimpse of a future in which telecommunications networks not only provide connectivity, but also support time-dependent and location-dependent applications much faster and more

accurately than current satellite navigation systems such as GPS. These results have been achieved in the [SuperGPS project](#), a partnership between the Dutch Metrology Institute ([VSL](#)), [TU Delft](#) and [VU Amsterdam](#).

This is the first demonstration of a system that can provide both connectivity like mobile and Wi-Fi networks do, and accurate positioning and time-related information like GPS does. This technology is expected to be important for applications such as autonomous driving, quantum communications, renewable energy and next-generation mobile networks. "The goal of the project was to develop an alternative mobile network-based rather than satellite-based positioning system that would also be more robust and accurate than GPS," said Jeroen Koelemeij, assistant professor at VU Amsterdam.

Growing Need for Alternative Navigation System

A lot of vital infrastructure depends on satellite navigation systems like the American GPS and the European Galileo. However, these systems have limitations and vulnerabilities; the radio signals are weak, and the reflection or blocking of radio signals by buildings negatively affects the positioning accuracy. Added to this is the growing concern among national authorities about the increased use of illegal jamming devices to interfere with radio waves.

"Besides vital infrastructure, citizens and authorities also rely on GPS and similar satellite navigation systems, but there is no backup system," commented TU Delft's Christian Tiberius who is coordinating the project. "We realized that with a few smart and innovative adjustments, we could transform the telecommunications network into a highly accurate alternative to GPS."

A Hybrid Fibre-optic/wireless System with GPS Accuracy

One of those innovations entails connecting a highly accurate atomic clock to the mobile network which allows the system to send perfectly timed messages for positioning, just like GPS does using atomic clocks in the satellites. This connection uses the existing fibre-optic network. "Thanks to this technique, we can turn the network into an atomic clock with nationwide coverage, creating countless new applications such as accurate positioning. And the hybrid fibre-optic/wireless system we have now developed allows basically anyone to access our atomic time. This provides an extremely accurate radio clock that is accurate to a billionth of a second," stated Erik Dierikx, a scientist at VSL.

In addition, the system uses radio signals with much greater bandwidth than normal. This helps to recognize confusing reflections in the navigation equipment, thus increasing the positioning accuracy. "At the same time, bandwidth in the radio spectrum is scarce and therefore costly. To overcome that, we use signals in a number of narrower bandwidths spread over a large 'virtual' bandwidth. This means that the signals actually use only a small part of the radio spectrum, and they are also more similar to what is currently used in mobile networks," said Gerard Janssen from TU Delft.

The results of this study were recently [published](#) in the scientific journal Nature. These results were partly funded by grants from the Applied Engineering Sciences domain of the Dutch Research Council (NWO).



The proposed system turns the existing mobile network into an atomic clock with nationwide coverage, creating countless new positioning-based applications. (Courtesy: Stephan Timmers/TU Delft)

