Internet-Based SuperGPS

Description

Conventional satellite-based GPS is excellent at positioning in large open spaces without obstacles, but it can struggle in dense areas such as cities. This is not a problem for cars as long as the driver is human and can correctly interpret the situation without having a precisely pinpointed GPS location.

However, an inaccurate GPS signal can lead to unsafe conditions for autonomous vehicles in such dense urban areas. Therefore, the concept of a SuperGPS based on a terrestrial time and frequency transfer (TFT) network running over optical fibres combined with radio transmitters has emerged.

Precise and reliable time synchronisation is a crucial piece of such a SuperGPS. Experiments have shown that such functionality can be delivered for a SuperGPS system via a TFT network and radio transmitters. However, a TFT network runs over its own dedicated fibreoptic infrastructure which creates costs and deployment complexity.

Quantum technology on the other hand provides an opportunity to run a time synchronisation protocol over a generic quantum internet infrastructure. This means that once the quantum internet becomes a reality deploying a SuperGPS might become just a matter of deploying internet-connected radio transmitters.

Quantum advantage

A SuperGPS using a quantum internet-based clock should achieve at least the same accuracy as with a TFT network. The quantum advantage lies in the ability of deploying the time synchronisation technology over generic quantum internet infrastructure which is expected to be deployed for other generic usage. Therefore, once quantum networks become ubiquitous, a quantum

internet-based SuperGPS could be deployed in any location that is already connected to the quantum internet without any additional fibre-based infrastructure such as a dedicated TFT network.

Theoretically the accuracy of the time synchronisation could be pushed beyond classical limits, but this is not necessary for the quantum advantage.