

CONF42

Quantum Sensors

Revolutionizing GPS
Technology

By Amit Modhwadia

Introduction

I'm Amit Modhwadia

- I am pursuing my bachelors degree in Computer Science at SRM Institute of Science & Technology.



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What is Quantum Sensors ?

Quantum Sensors an advanced sensor technology that detects changes in motion, force, electric and magnetic fields, by collecting data at the atomic level.

How Quantum Sensors Works ?

- A Quantum Sensors utilizes properties of quantum mechanics, such as quantum entanglement, quantum interference, and quantum state squeezing, which have optimized precision and beat current limits in sensor technology.

Types of Quantum Sensors

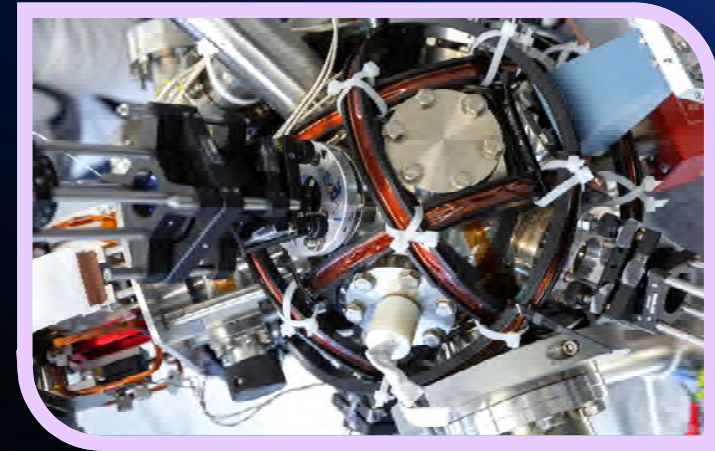
There are many types of Quantum Sensors but mainly it is used to precisely measure the ...

Acceleration

Force

Magnetic & Gravitational fields etc.

Quantum Accelerometer



Close-up of the accelerometer

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- The quantum accelerometer uses ultracold atoms to make highly accurate measurements.
- When cooled to extremely low temperatures the atoms start to display their 'Quantum' nature, resulting in wave-like properties.
- As the atoms move through the sensor, an 'optical ruler' is formed by using a series of laser pulses. This allows the acceleration of the atoms to be precisely measured.

Quantum 'compass'

- Most navigation today relies on a global navigation satellite system (GNSS), such as GPS, which sends and receives signals from satellites orbiting the Earth.
- But The quantum accelerometer is a self-contained system that does not rely on any external signals.

- Navigation using Quantum Accelerometer

- To navigate using a quantum accelerometer, we need the precise starting position, and by using the quantum accelerometer, we can measure acceleration very precisely, We can use both data to determine our position in 3D space.

Traditional Navigation using GPS

VS

Navigation Using Quantum Sensors

- To Navigate using Global Positioning System (GPS) we need external source like satellites and for precise measurement we need 4 – 5 satellites, because it is depended on external source like satellite it's easy to Jam or hack it.
- On the other hand Quantum 'compass' will not rely on external source. Because of this it will give more accurate Navigation and it's difficult to hack.

What is the progress ?

- The UK's first quantum accelerometer for navigation has been demonstrated by a team from Imperial College London.
- A prototype quantum sensor built at Imperial, with potential application in GPS-free navigation, has been tested in collaboration with the Royal Navy.



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Thank you

~ Amit Modhwadia

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