A robust, calibration-free, and ultra-sensitive magnetometer for remote magnetic field sensing applications

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Abstract: Magnetometers or magnetic field sensors are frequently used on aircraft, spacecraft, drones, and navigational systems for oil and mineral exploration, geophysical surveys, and outer space exploration. These applications need calibration-free, highly sensitive, and fast magnetic field measurement scheme. The existing technology is heavyweight and bulky, and unsuitable for lightweight carriers such as drones. We are designing a compact and lightweight magnetic field sensing device using Nitrogen-Vacancy (NV) center in diamond as a magnetic field sensor combined with an accelerated measurement scheme called an optimal Bayesian measurement algorithm. The diamonds substrate is a good choice because it can sustain a harsh environment such as outer space. We will be using the electrically detected magnetic resonance (EDMR) technique to measure the magnetic field. The EDMR measurement is highly sensitive, relies on quantum physics, and is independent of environmental effects such as temperature changes. In this presentation, I will be discussing our progress towards prototyping such a magnetic field sensing device.

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