Low-frequency photonics-based broadband radar imaging & sensing

IP Ref 2020-004

Defence, Security & Safety

Opportunity

Radars in applications like security inspection, internal testing, autopilot, & target identification have demands for accurate ranging & high spatial resolution which requires radars to be operated at high frequencies & with broad bandwidth. Conventional electronic-based systems & newer photonics-based systems can do this, but with increasing cost & complexity.

Technology

This technology is a photonics-based radar system which can achieve high performance using low, megahertz frequency optical electronics.

A frequency-shifting fibre optic loop and a continuous wave laser beam are used to generate stepped frequency waveforms over a broad range of frequencies. A tap of transmitting signal is be sent into the electro-optic modulator, modulated by the received signal & filtered by an optical bandpass filter. The filtered signal is converted into electrical signal by the optoelectric converter, sampled by the analogue-to-digital converter and processed by the digital signal processing unit.

This technology adds low cost & simple architecture to the existing advantages of photonics-based radar. The system could be used the lower the cost of existing radar applications, such as synthetic aperture radar (SAR) imaging, ground penetrating radar, or multiple-input & multiple-output (MIMO) radar. Alternatively, the system's millimetre-range precision & penetration ability permits monitoring of a living target's respiration rate, heart rate, and blood pressure.

The system has been tested in real-time, range-Doppler imaging, where it demonstrated a tuneable bandwidth exceeding 20 GHz and <1 cm range resolution.

Intellectual Property Status

Protected by PCT/AU2021/050396

Inventors

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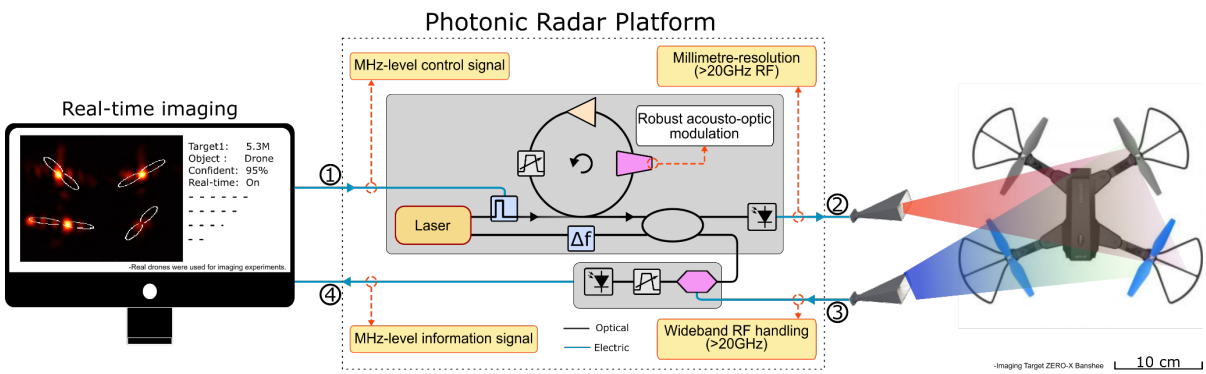
Scientific Data

Zhang, Z., Liu, Y., Burla, M., & Eggleton, B. J. (2020, May). 5.6-GHz-Bandwidth Photonic Stepped-Frequency Radar using MHz-level Frequency-Shifting Modulation. In 2020 Conference on Lasers and Electro-Optics (CLEO-US) (pp. 1-2). IEEE. Invited talk

TRL 1-3 → TRL 4-6 → TRL 7-9



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