Docket #: S24-166

A high resolution, near THz imaging system for all weather environmental mapping

Researchers at Stanford University have developed a novel millimeter wave imaging radar system designed to enhance driver-assistance technologies.

Current automotive sensors, such as phased arrays and multiple-input multiple-output (MIMO) systems, struggle with high cost, limited field-of-view (FoV), and slow refresh rates, which can degrade performance in dynamic driving environments.

This technology addresses these limitations by utilizing a plastic Fresnel lens combined with a 65 nm CMOS imaging array to achieve high angular resolution. The system operates at 220 GHz, offering 0.78° angular resolution and 3 m range resolution. This approach simplifies the receiver architecture and eliminates additional latency, providing a cost-effective and efficient solution. Potential applications include advanced driver-assistance systems (ADAS) and autonomous vehicles, where high-resolution imaging is critical for object detection in various weather conditions. This technology could greatly enhance safety and reliability in automotive systems.

Stage of Development

- Proof of Concept

Figure:

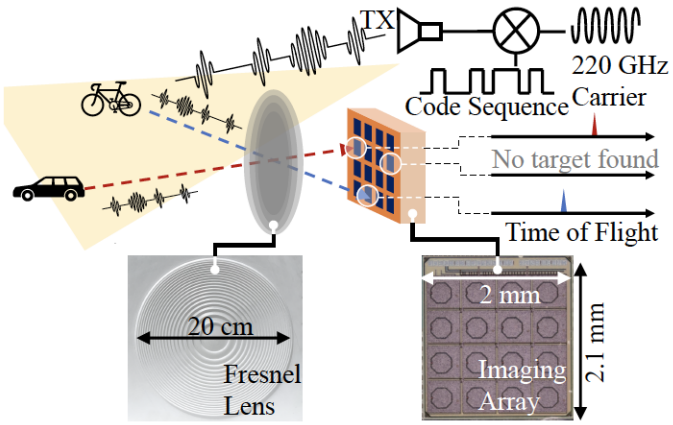


Figure description: Block diagram of the proposed focal planar imaging array. The prototype imaging array consists of a beamforming Fresnel lens and a 4x4 receiver array in 65 nm CMOS.

Image credit: Publication

Applications

- Automotive sensor
- Outdoor motion detection
- Security scanning

Advantages

- Scalable - requires no specialized manufacturing processes
- Cost Effective - costs 100 times less than existing LIDAR and radar mapping solutions
- Weather proof - Reduces weather-related signal degradation compared to LiDAR by 15 dB
- Immune to near-by interference

Publications

- Xu, Y., Hassibi, A., & Lee, T. H. (2023, June). A 220 GHz Code-Domain Focal Plane Imaging Radar with 0.78° Angular Resolution for Automotive Applications. *In 2023 IEEE/MTT-S International Microwave Symposium-IMS 2023* (pp. 446-

449). IEEE.

Patents

- Published Application: 20250370089

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