A Novel 3D-Camera using Electro Absorption Modulator (DREAM)

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The DREAM camera employs a novel time-of-flight (ToF) method for 3D image taking. This technology offers a working range from ten centimetres to several meters by utilizing laser illumination, a monochrome camera, and advanced electroabsorption modulators (EAMs). The integration of hardware and modern software ensures enhanced precision and depth resolution, with applications spanning robotics, process monitoring, and augmented reality.

- Working range from 10 cm to several meters
- Reduced interference from multiple reflections, motion artifacts, and noise
- High lateral resolution with resonant electroabsorption modulators
- Comparable depth resolution quality to existing technologies, even without complex modulation forms and extensive image processing
- Doubling of the frame rate of the 3D camera at a minimum

Fields of application

Due to its versatile working range, the DREAM camera has potential applications in robotics, process monitoring, and control. Its compact design also allows integration into existing camera systems, making it suitable for mobile devices in virtual and augmented reality applications. MedTech would be another potential application for this invention. Consideration for power consumption and computing power is crucial, with the possibility of implementing lightweight networks for simple error corrections on smartphones and more complex corrections on separate servers, particularly in stationary industrial environments.

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TRL4 - Technology validated in lab

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Service
Technologie-Lizenz-Büro GmbH has been entrusted with exploiting this technology and assisting companies in obtaining licenses.

Background

Optical 3D image capture has gained prominence in industrial and consumer applications in recent years. Time-of-flight (ToF) measurement, particularly using the DREAM project's approach, offers a simplified yet real-time-capable method for 3D image acquisition. The invention combines laser illumination, a monochrome camera, and a high-frequency modulated global shutter synchronized with the laser to enhance the ToF process.

Problem

Existing 3D cameras face challenges related to multiple reflections, motion artifacts, and noise, impacting data accuracy. The power consumption and computing requirements also need to be revised, especially in mobile devices and applications requiring lightweight and energy-efficient solutions.

Solution

Researchers at the University of Ulm have developed a novel, patent-pending, innovative solution to overcome these challenges. The DREAM invention addresses these challenges by developing optoelectronic electroabsorption modulators (EAMs) and integrating them with a hardware setup for ToF image acquisition. Modern software approaches, including deep learning, are employed for data evaluation and error correction. The proposed camera demonstrates improved precision and depth resolution compared to existing technologies.

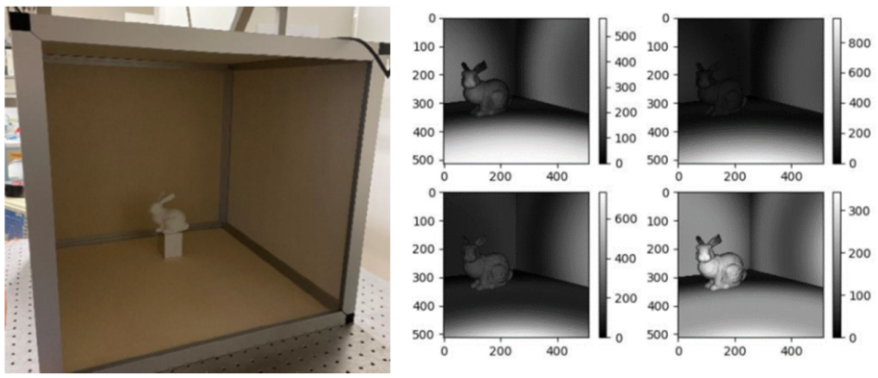

Figure 1: Left: Cornell box with an object produced using a 3D printer, the Cornell box is a cube with an edge length of 50 cm. The Stanford Bunny object is about 10 cm high. Right: Light intensity at the camera for different phase shifts. The horizontal and vertical axes count the camera pixels. The greyscale bar is intensity in arbitrary units. The figure does not contain depth information.[R. Michalzik et al, Institute for Functional Nanosystems, University of Ulm]