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Structured Light System Calibration with All Digital Features

Digital calibration method lowering cost and complexity for accurate structured light 3D sensors.

Researchers at Purdue University have developed a method for structured light system calibration. Three-dimensional (3D) optical metrology has become a critical resource for the manufacturing industry, law enforcement, and healthcare. Specifically, the structured light technique is one of the most extensively adopted methods for its low cost, flexibility, and implementation. However, existing light system calibration methods for these techniques often require precisely made calibration targets with real physical features or an expensive high-precision translation stage.

The structured light system calibration method developed by Purdue University researchers helps manufacturers fabricate 3D structured light sensors with greater flexibility and simplicity in achieving accurate calibration. Unlike state-of-the-art methods which require complicated and expensive calibration fixtures, this completely digital method reduces calibration fixture costs while also eliminating the need for calibration targets with physical features. Through harnessing a digital display to present digital feature patterns for camera intrinsic calibration, this method is made more accessible and easier to implement.

Technology Validation:

The researchers evaluated the performance of the calibration method by conducting 19 plane measurements with different orientations and positions. For a measurement volume of 193(x) Ã— 143(y) Ã— 148(z) mm3 , the achieved root-mean-square (rms) errors were all below 0.20 mm with a mean value of 0.145 mm and standard deviation of 0.018 mm. These experimental results demonstrated that the proposed method can achieve reasonably high measurement accuracy for a standard structured light system.

Advantages:

Technology ID
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Category
Robotics & Automation/3D Perception & Modeling for Automation

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-Does not require specially made expensive calibration target or expensive translation stage for system calibration

-Inexpensive and accessible

-Permits the use of existing open-source calibration software packages without additional development

Applications:

-Manufacturing

-Healthcare

-Law enforcement

-Structured light 3D sensors

TRL: 4

Intellectual Property:

Provisional-Gov. Funding, 2023-05-04, United States

Utility-Gov. Funding, 2024-05-03, United States

Keywords: structured light calibration,3D optical metrology,digital calibration system,low cost calibration method,manufacturing inspection technology,healthcare imaging systems,lens calibration automation,law enforcement 3D scanning,optical measurement accuracy,structured light sensors