Towards Better 3D Data Aquisition
High-accuracy and High-efficiency Fringe Projection Profilometry

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Project Motivations:

To capture detailed and accurate information about the physical world, which is crucial in creating precision point cloud data. This, in turn, has numerous applications, such as improving real-time navigation and obstacle detection in autonomous driving and enhancing accuracy in remote surgery.

Project Objectives:

This project aims to improve the calibration stage by integrating a subpixel edge detection method and the phase measurement stage by proposing an improved phase unwrapping method in the fringe projection profilometry (FPP) system. The goal is to design a higher accuracy and efficiency FPP system. This project will help to advance further studies in achieving a better real-time 3D data acquisition system.

What is FPP:

A simple FPP system can be achieved by replacing one of the cameras in the stereo vision with a projector that illuminates the object with pre-defined patterns. The resulting deformed light patterns are captured by the camera. To obtain the 3D data, image processing is performed on the captured images to generate the 3D information.
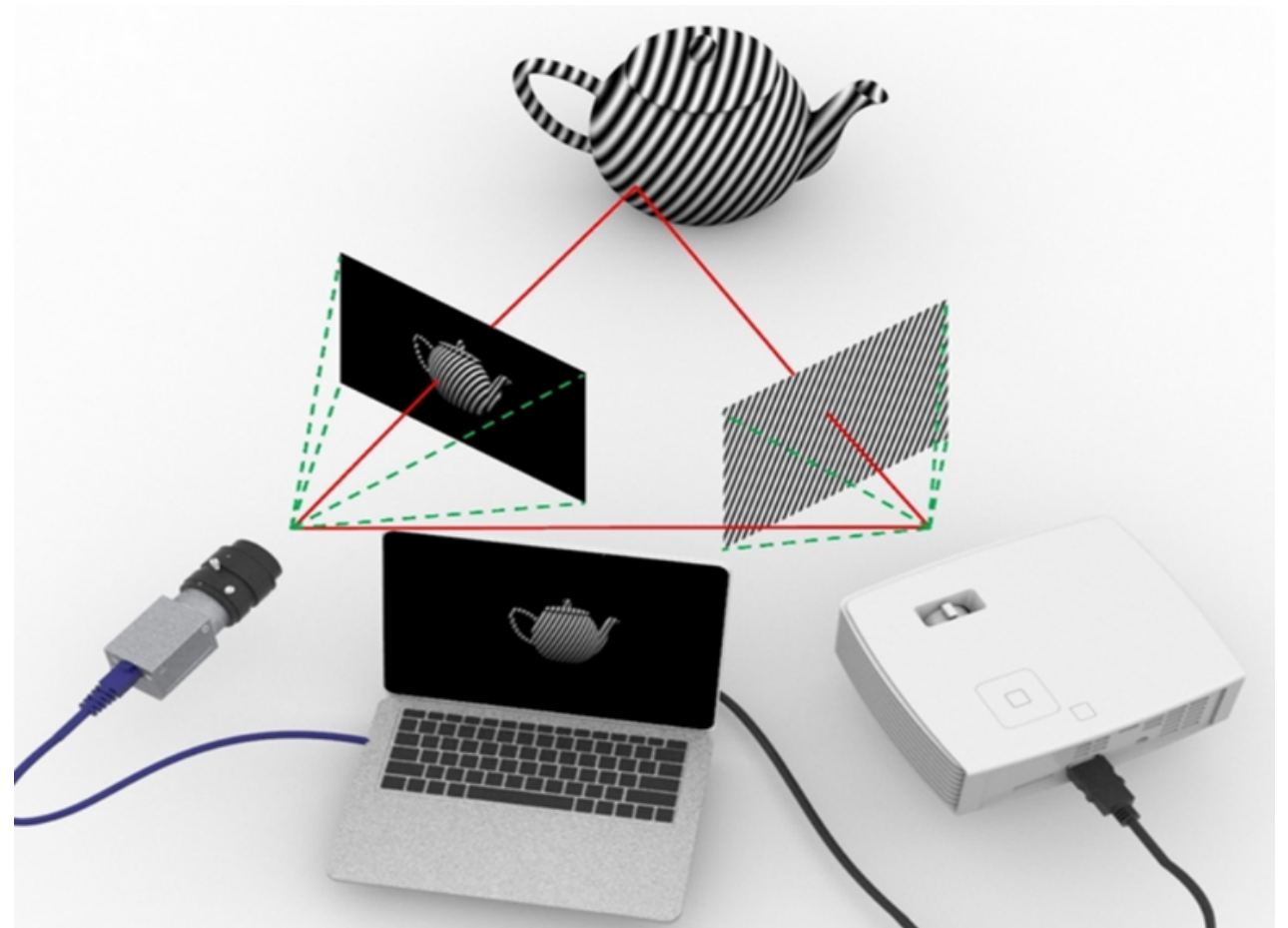
Achievements:

High quality 3D point cloud data can be generated using the proposed methods. The accuracy of the calibration stage was improved by 33%. The efficiency of the phase measurement stage was improved by 26%, and it is more concise than all other methods, achieving an 1/6 improve on the phase period used.