(S015)
Projector Calibration Using Passive Stereo and Triangulation

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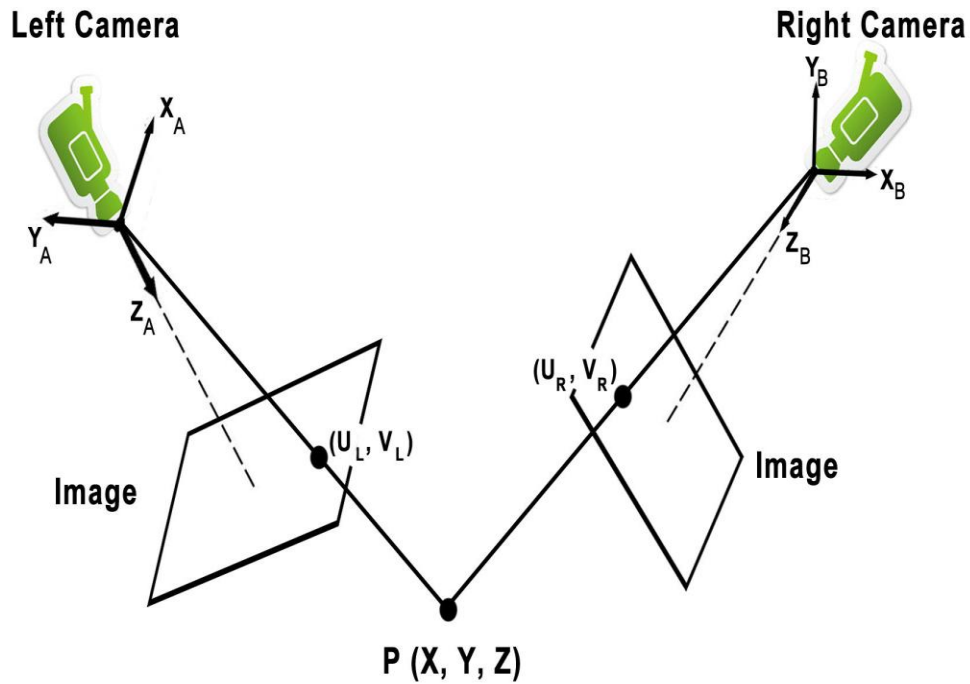
Projector Calibration Using Passive Stereo and Triangulation

Outline

- **INTRODUCTION**

- **SYSTEM OVERVIEW**

- **PROJECTOR CALIBRATION**
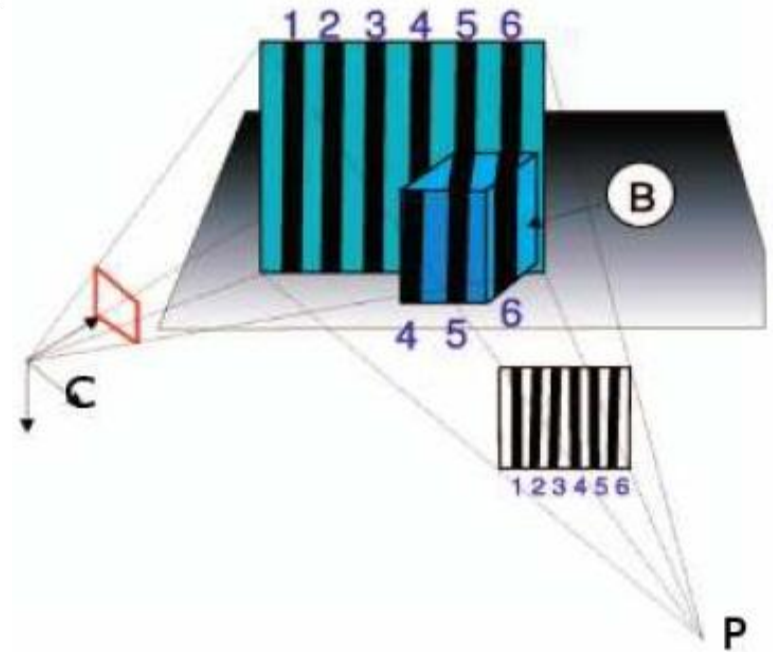
- **RESULTS**

- **References**

Introduction

- This paper addresses the problem of projector calibration which is critical step in any active vision systems, and particularly in active optical scanners.

- Passive optical scanners do not require direct control of any illumination source.

- First, the 2D projection of a given point is identified in each camera. Using the calibration parameters of each camera, a single 3D line is drawn from each camera's center of projection through the 3D point. The depth of the point is recovered by the intersection of these two lines. The main problem in these systems is correspondences matching among the various viewpoints.

- The projector plays an important part in solving the correspondence problem. It projects coded patterns on the scanned object. By capturing the deformed pattern using cameras, the correspondences between image pixels and projector (columns-rows) can be found easily.

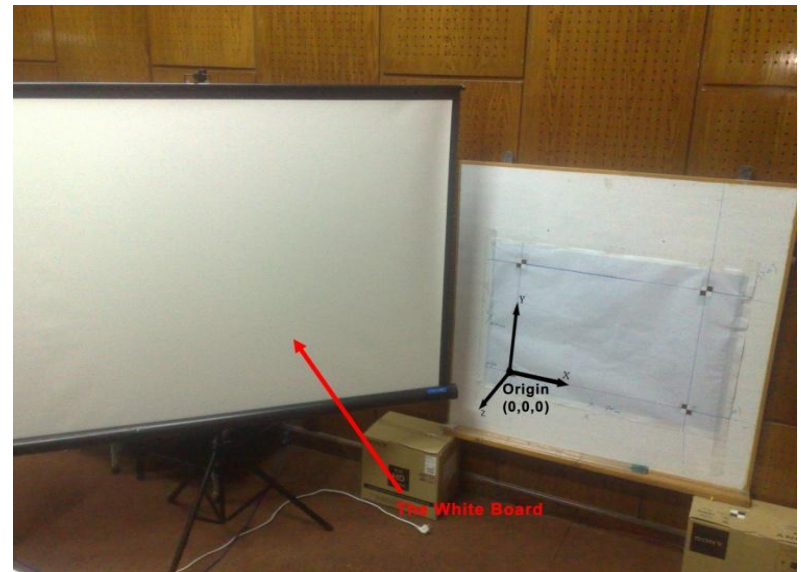# Introduction (cont.)

Passive Stereo   Active Stereo

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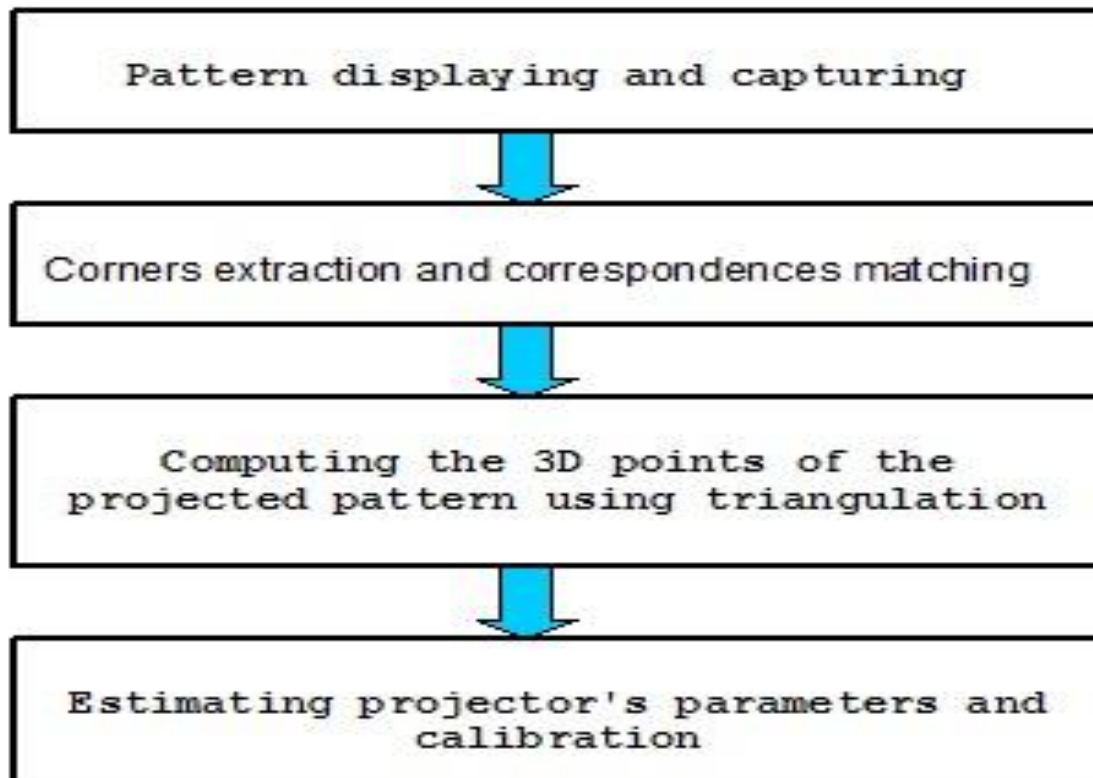
- RESULTS

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System Overview

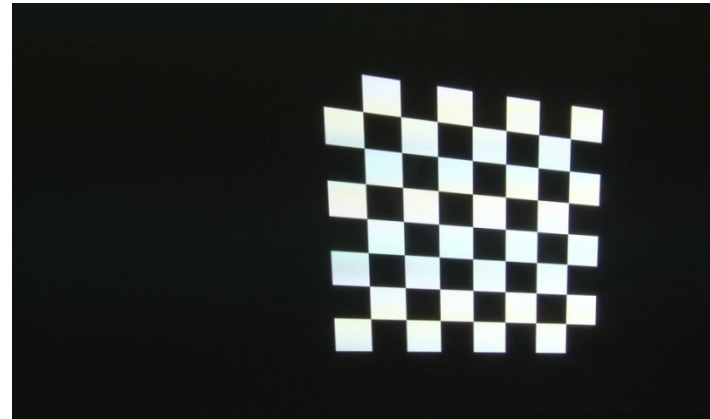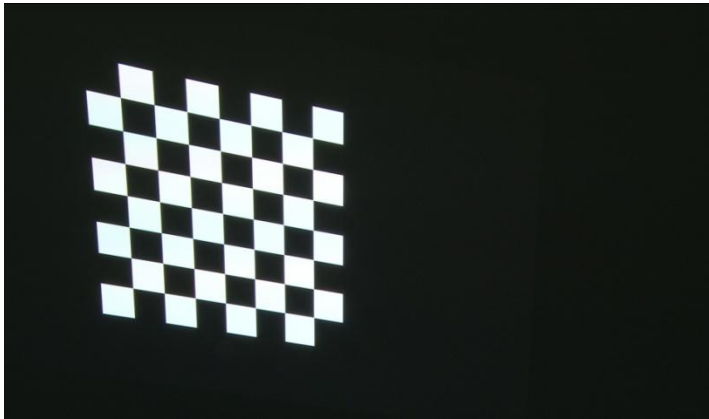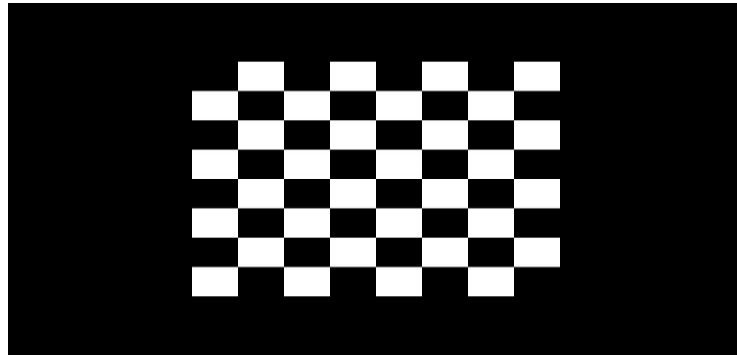- Our system consists of two calibrated cameras (left-right), white board, and projector.
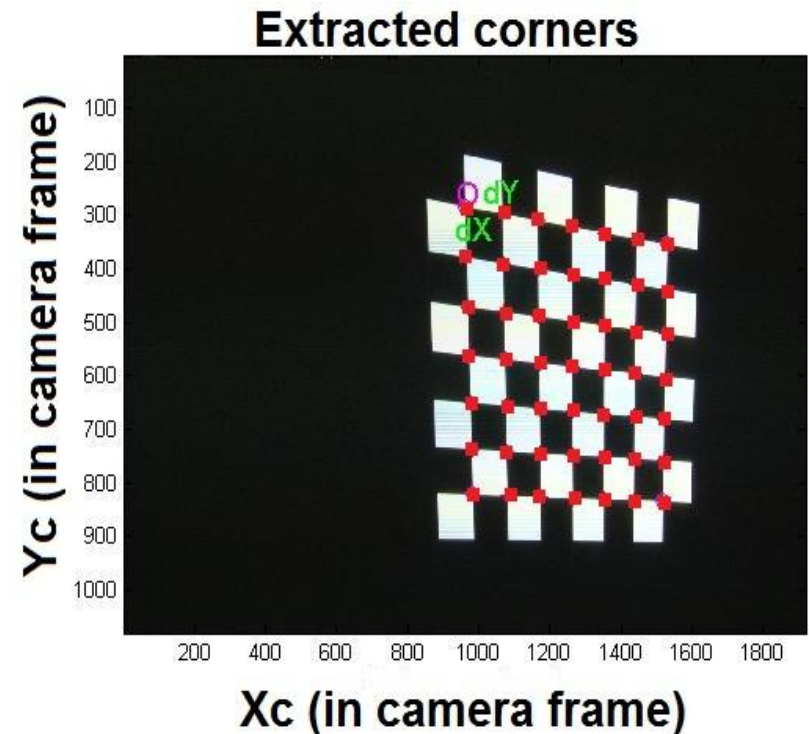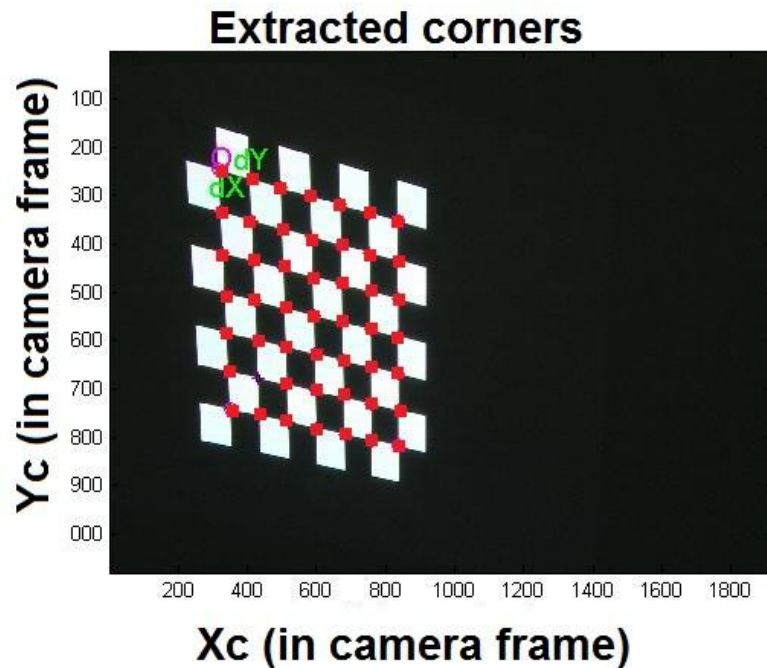
System Overview (cont.)

- Overview of our pipeline.
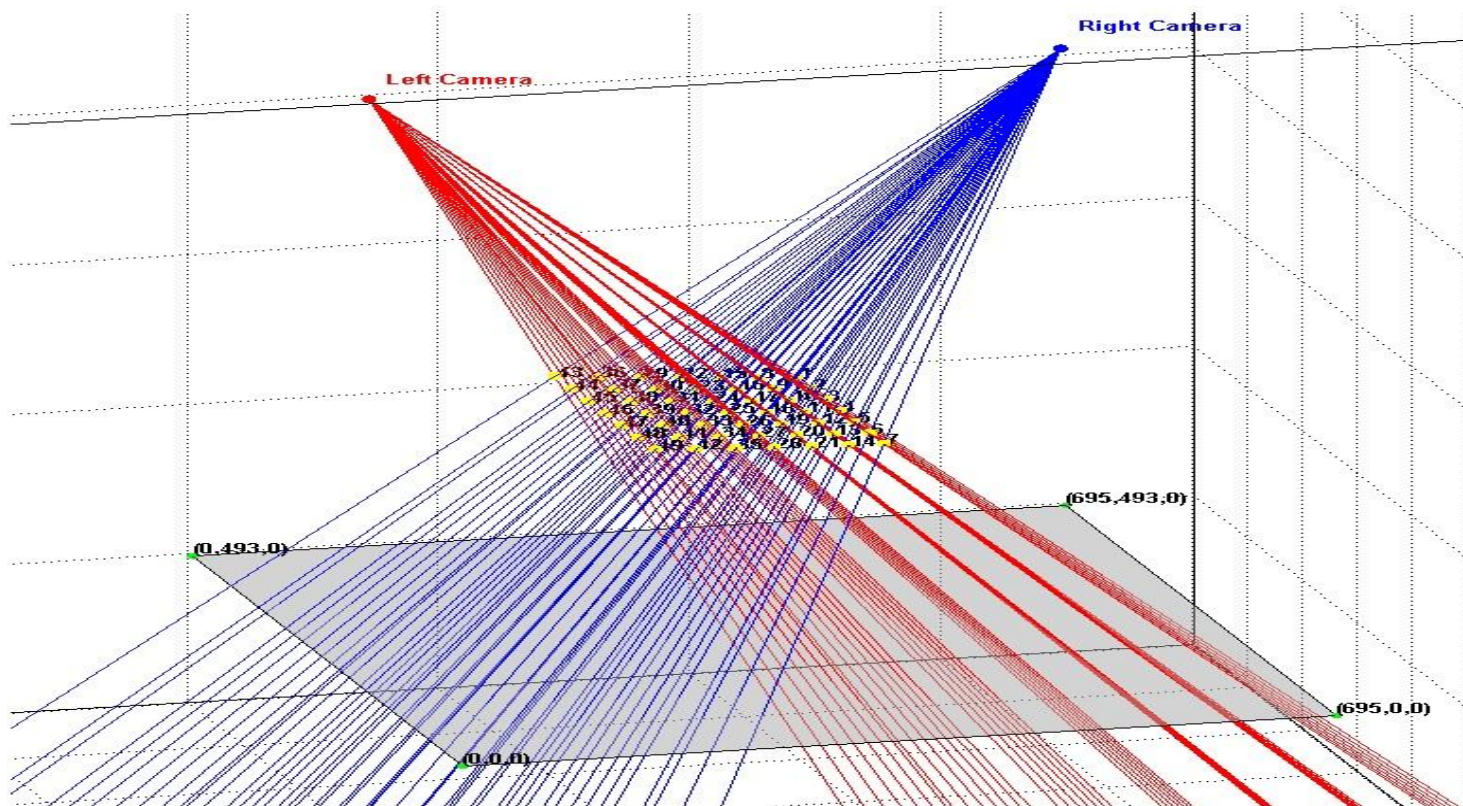
System Overview (cont.)

- ■ *(1) Pattern Displaying and Capturing*

System Overview (cont.)

- *(2) Corners Extraction and correspondence matching.*

- (3) RECONSTRUCTION BY TRIANGULATION.

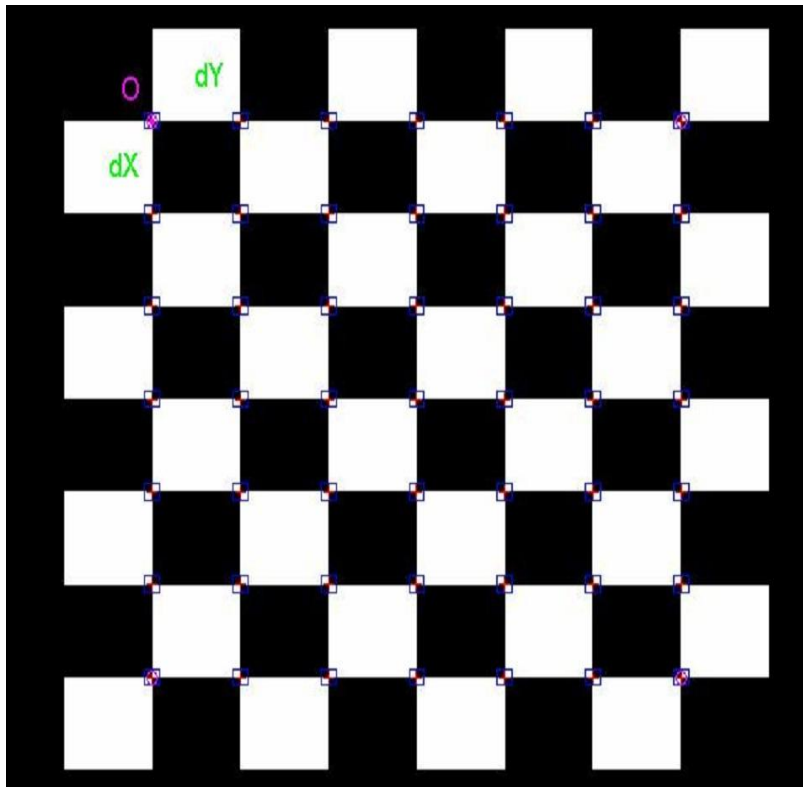Projector Calibration Using Passive Stereo and Triangulation

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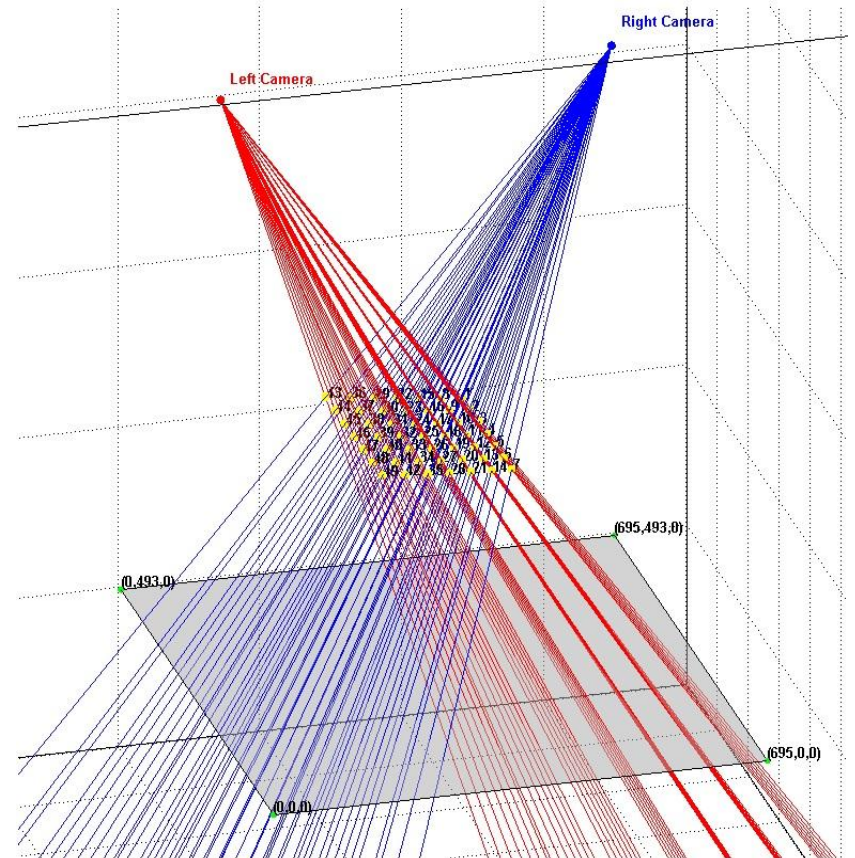- PROJECTOR CALIBRATION

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Projector Calibration

- Now, we have the 3D coordinates of the projected checkerboard pattern and the 2D corners of the projected pattern in the projector frame can be obtained by extracting the corners of the image projected by the projector. Finally, the system is ready for calibration.

Projector Calibration (cont.)

2D points in projector frame

3D points estimated

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Projector Calibration (cont.)

- Modeling the projector as camera inverse lets us use any camera calibration methods to calibrate our projector like Zhangs method.

- Projector calibration requires estimating the parameters of the general pin-hole model.

- This includes the intrinsic parameters, being focal length, principal point, and the scale factors, as well as the extrinsic parameters, defined by the rotation matrix and translation vector mapping between the world and camera coordinate systems.
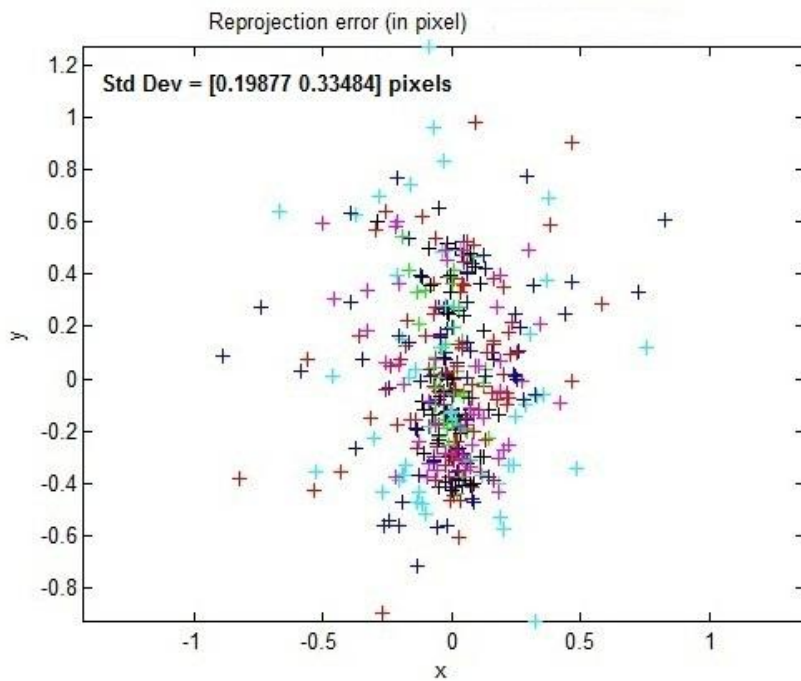
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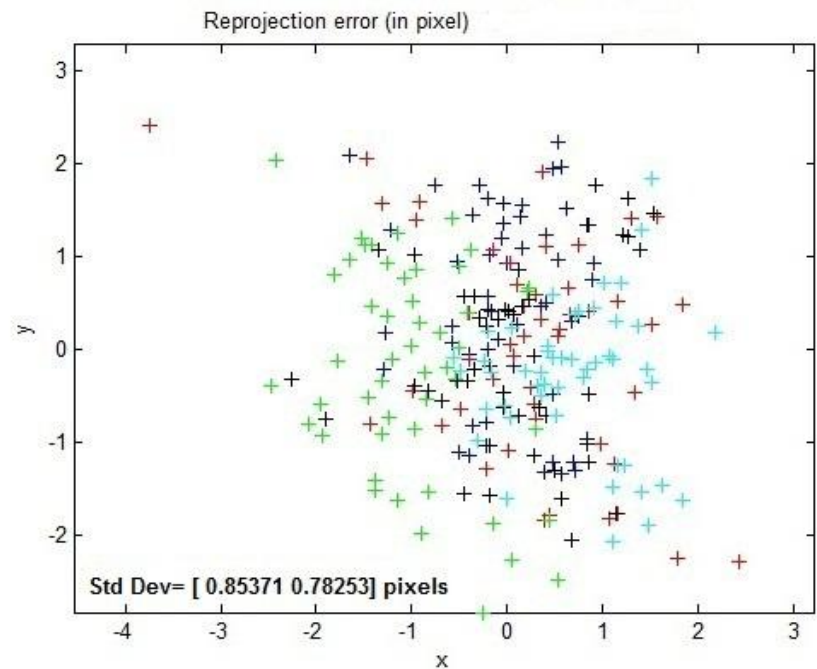- PROJECTOR CALIBRATION

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Results

- Our method is more accurate than Gabriel Falcao et al. method. Our method's average standard deviation of the error is [0.19877 0.33484] pixels while [0.85371 .78253] pixels for Gabriel Falcao et al. method.
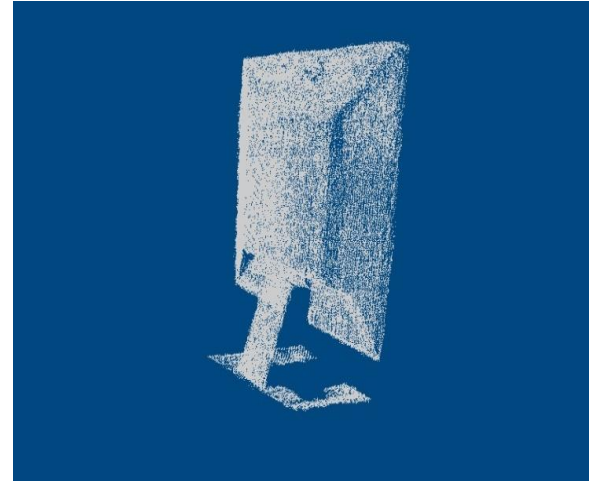
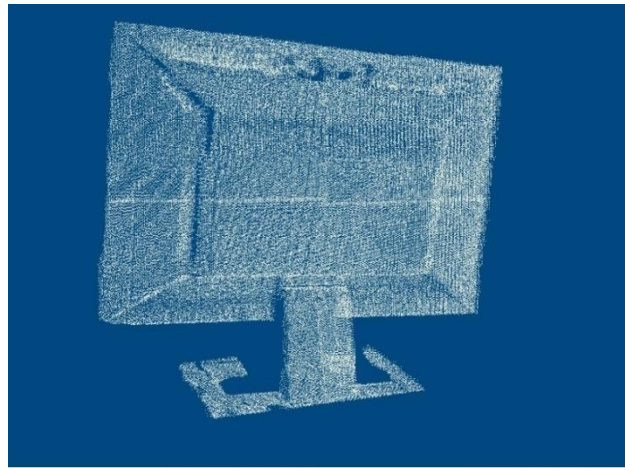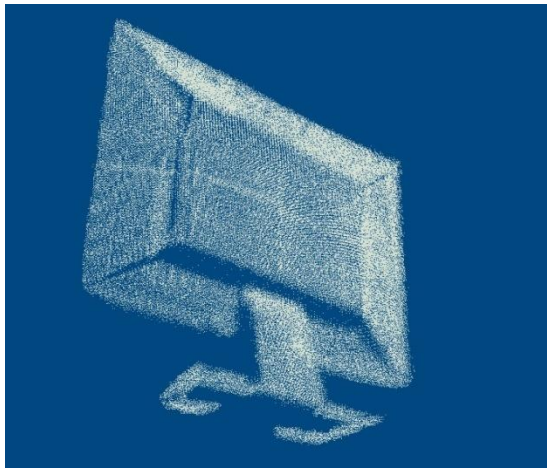# Results (cont.)
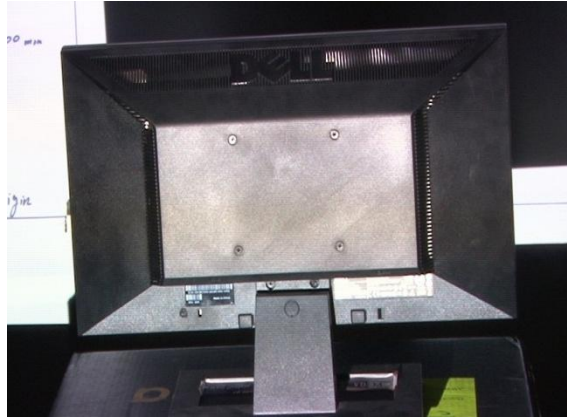

Reprojection error of the proposed method

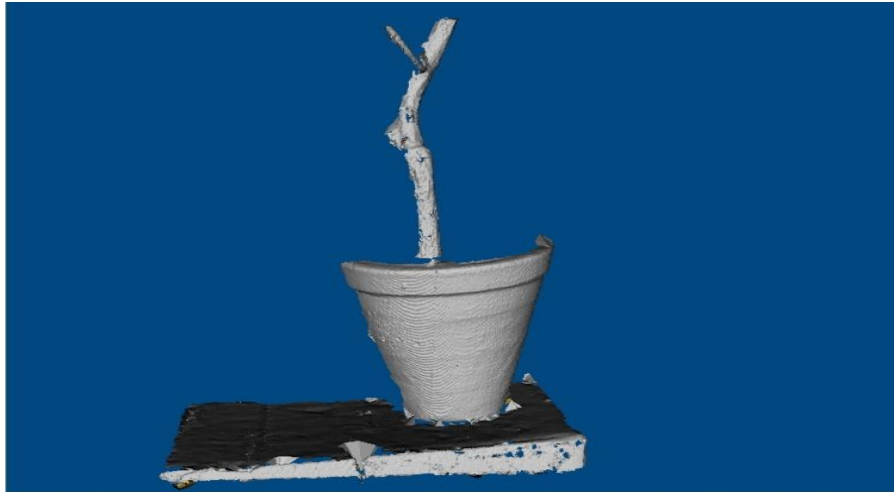Reprojection error of Gabriel Falcao et al. method.

Results (cont.)

- 3D objects reconstruction using our method

Results (cont.)
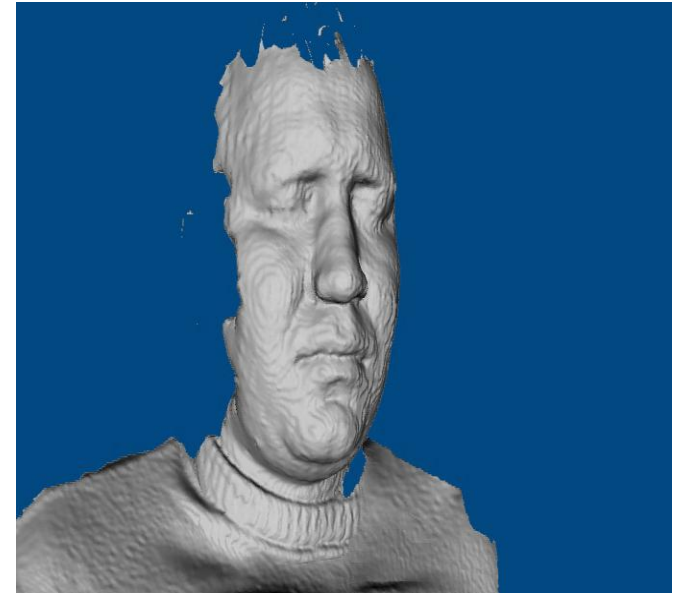

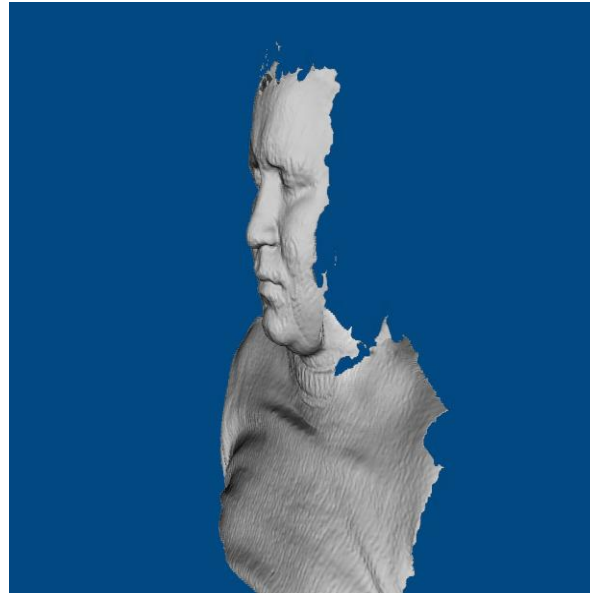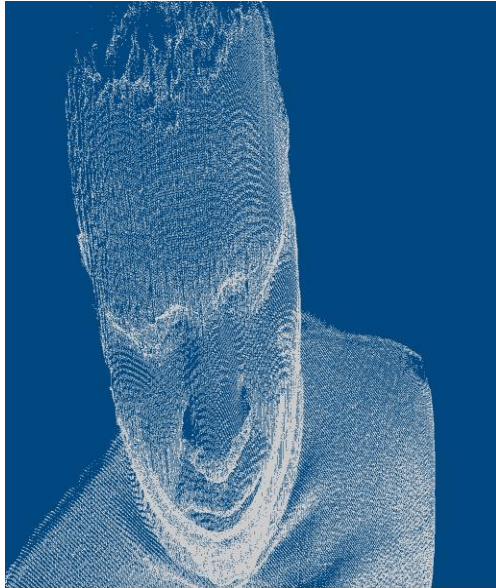Projector Calibration Using Passive Stereo and Triangulation

Results (cont.)

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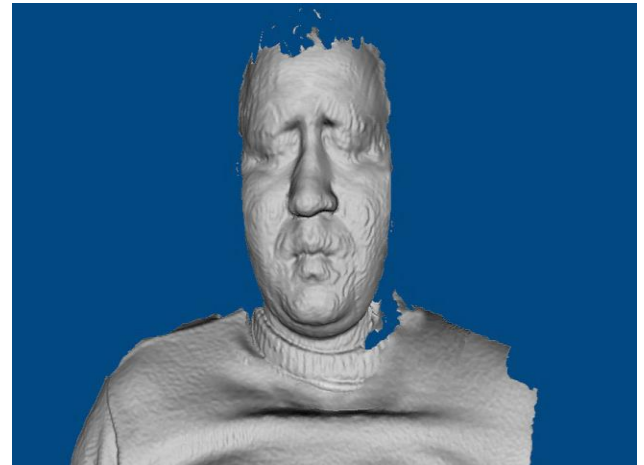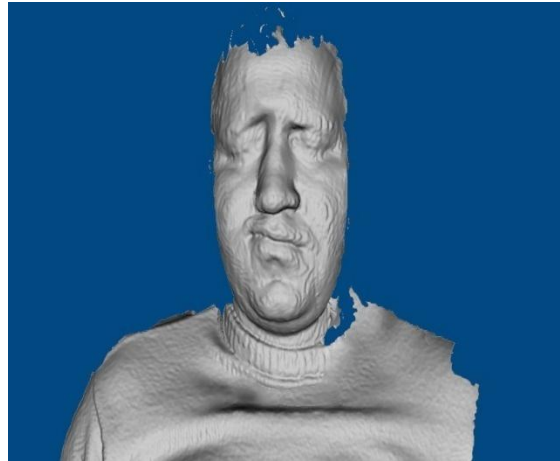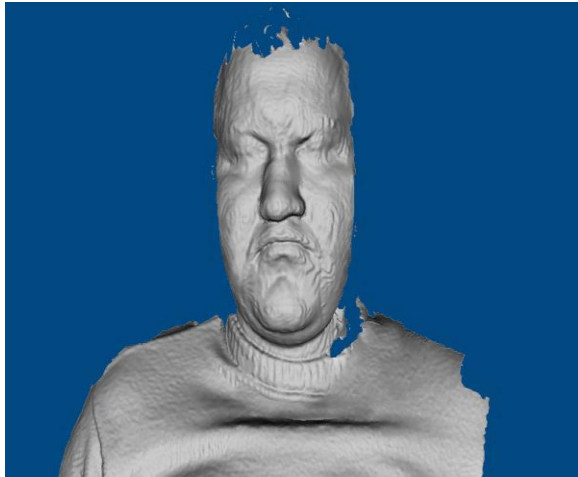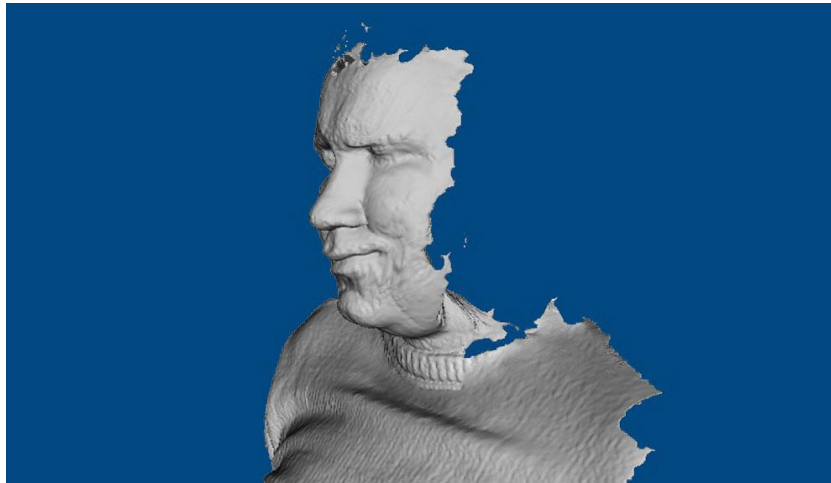

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Results (cont.)

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- J. Y. Bouguet, "Camera calibration toolbox for Matlab,"www.vision.caltech.edu/bouguetj/calib_doc/, *2008.*

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Thank You

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