INTRODUCTION

Our goal is to develop an economical and robust scanner for producing three-dimensional (3D) models of sub-meter scale objects with centimeter-scale resolution. We mount stereo camera pairs on an aluminum scanning arc controlled by a stepper motor. These camera pairs acquire image pairs of a centered object as the motor rotates the aluminum arc, performing a scan. By first calibrating these pairs of low-cost internet-protocol (IP) cameras, we can convert the pixel disparity between image pairs to depth. We generate a point cloud from each of these pairs and generate a 3D point cloud using the calibration data. These point clouds are then aligned using the small checkerboard and merged.

EXPERIMENTAL SETUP

Figure 5: Colored illustration of the 3D scanner
Figure 6: Stepper Motor
Figure 7: Mounted Stereo Camera Pair

3D SCAN DATA

Figure 12: Samples of point clouds during scans of the duct tape, the mug, and the goggles
Figure 13: Merged point clouds of the duct tape roll, the mug, and the goggles
Figure 14: Reprojection errors for sample data

ANALYSIS

Table 1: Dimensions of key object features: measured vs scanned

ACCURATE DIMENSIONS TO ~0.5 CM
HIGH SPATIAL NOISE
HOLES IN RAW DATA
NEEDS FURTHER IMAGE PROCESSING

SOURCES