OpenCV OpenGL Augmented Reality using ArUco Tags

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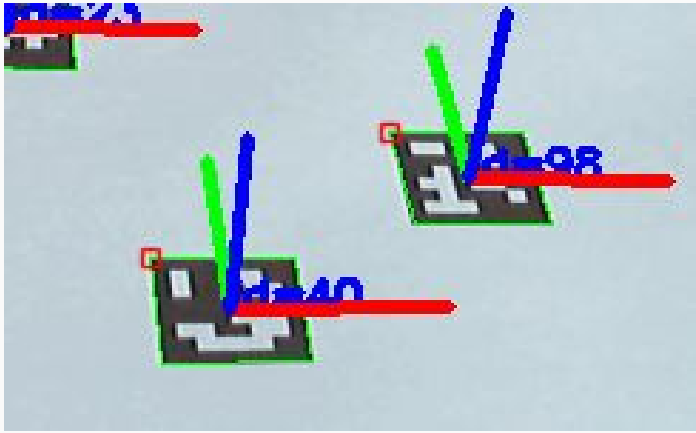
Introduction

- Recognize ArUco tags and use them to insert 3 dimensional objects into a live video feed

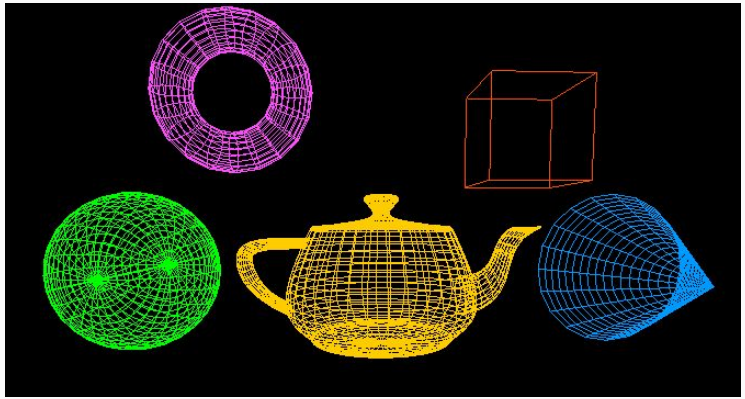
OpenCV

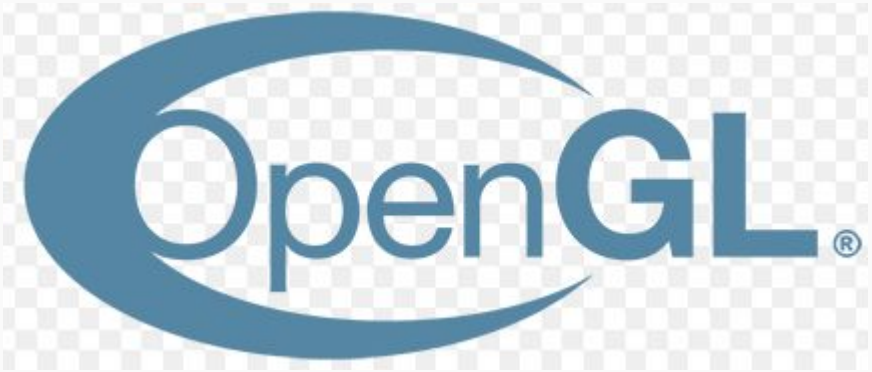
- Detect the ArUco tags and obtain their translation and rotation matrices
- Limited to drawing simple geometric shapes and lines
  - Needed alternative for implementing 3 dimensional models.



OpenGL

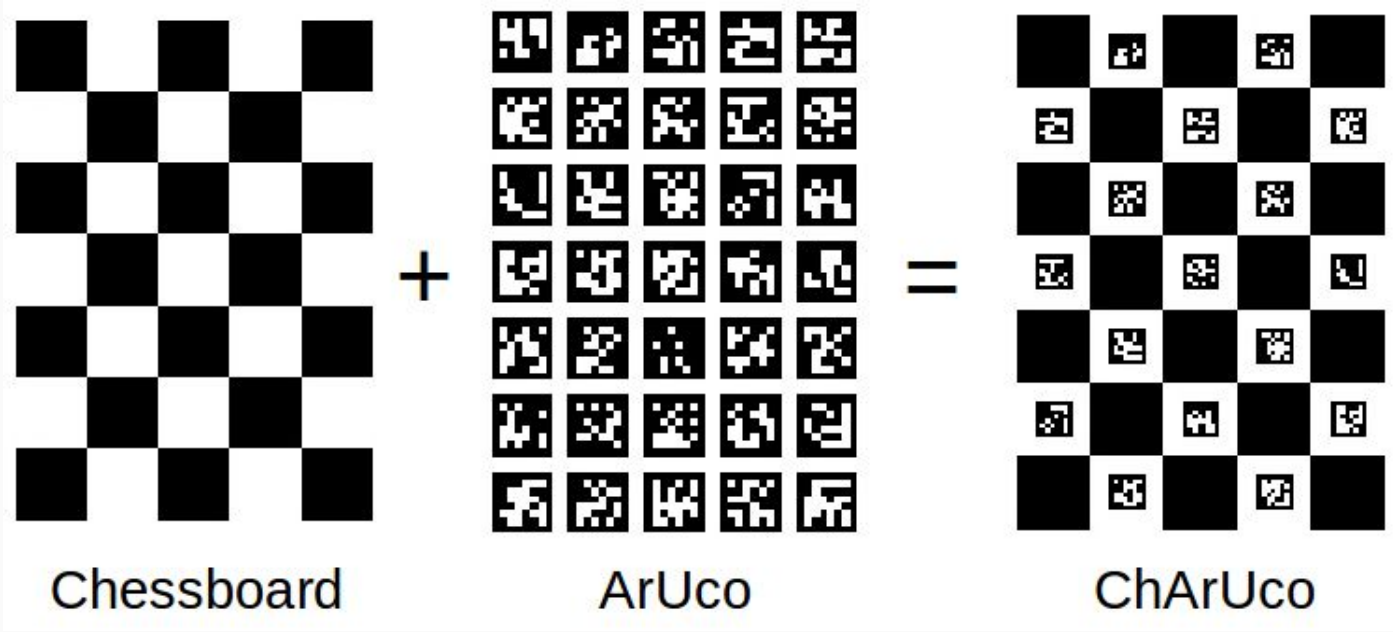
- OpenGL is an API specification for rendering graphics
- Full fledged graphics library which is used in many 3D applications and games
- Used to load in the 3D models and draw them to the screen





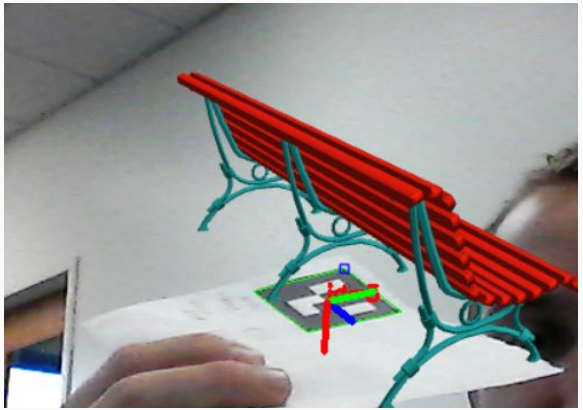
ChArUco Camera Calibration

- Using this method instead of a plain chessboard offers the advantages of
  - Allowing partial occlusion of the board
  - One or more of the board edges can be hidden



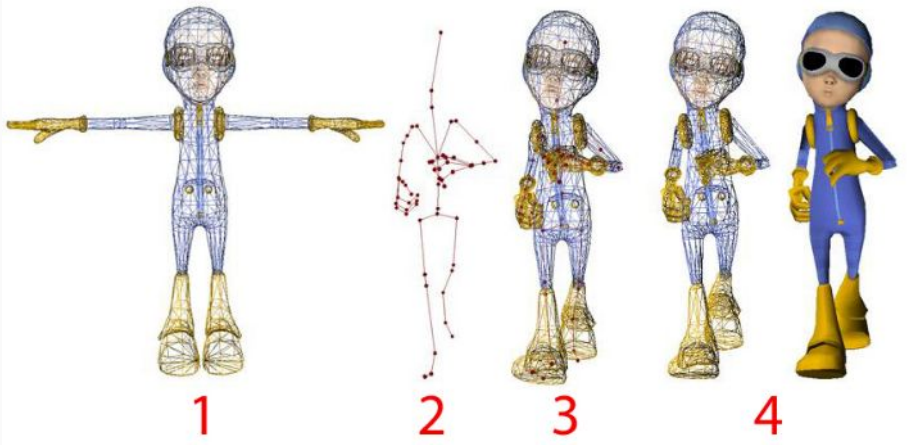
Averaging and Thresholding

- Averaging
  - ArUco tags are hard to pick out perfectly each time
  - Position of the marker is noisy and subsequently the models would shake
  - Averaging the last three position matrices helped to stabilize the models.
- Thresholding
  - Occasionally the detected Z-Axis of the marker would flip.
  - Constraining the change in Z-Axis to a certain threshold between frames solves this issue



Future Work

- Animation of Models
- Models interacting based on how close they are placed to each other
- Virtual Reality
- Real world lighting



Demo

https://github.com/avmeer/ComputerVisionAugmentedReality

Resources

Lighthouse3D.com OpenGL 3.3 + GLSL 3.3 Sample

http://www.lighthouse3d.com/cg-topics/code-samples/importing-3d-models-with-assimp/

Lighthouse3D.com OpenGL 3.3 Loading an Image File and Creating a Texture

http://www.lighthouse3d.com/2013/01/loading-and-image-file-and-creating-a-texture/

C++ 11 Multithreading Tutorial

https://solarianprogrammer.com/2011/12/16/cpp-11-thread-tutorial/

AruCo Camera Calibration

https://github.com/opencv/opencv_contrib/blob/master/modules/aruco/samples/calibrate_camera.cpp