Modern Robot Programming, PS7: camera calibration and vision-based manipulation

In PS5, you performed object manipulation by sliding/pushing, using feedback from a "magic" sensor (subscription to Gazebo topics that are not available in reality).

In this problem set, you will use a simulated color camera to create a realistic sensor, and use a simulated vacuum gripper for more capable manipulation.

The source code for this assignment is in the repository here:
https://github.com/wsnewman/irb140
You should remove all packages from your ros_ws/src directory, and "clone" this repository within ros_ws/src. i.e., navigate to your ros_ws/src directory and enter:
git clone https://github.com/wsnewman/irb140.git

then compile the code with catkin_make.

You can launch the code with:
roslaunch irb140_description irb140.launch

This will bring up several nodes, including a cartesian-motion action server, an openCV image-processing node, rviz and an image display node. You can move the block (blindly) by running the example cartesian task client:
rosrun cartesian_motion_commander example_block_grabber

Your objective in this assignment is to:
- modify the openCV code (example_opencv/find_block.cpp) to include an appropriate transform to specify the block centroid in robot coordinates
- modify the action client, cartesian_motion_commander/example_block_grabber, so that it subscribes to the openCV node to use the coordinates published by the image processor to grab the block
- move the block and place it (release it) at (your) specified coordinates, with an orientation of (0,0,0,1) (i.e., aligned with the robot's base frame)
- extend the openCV code to identify the orientation of the block (do this part last, as you can get most of the credit for achieving vision-based manipulation from the centroid alone)