Group #13 – Building Blocks

Alan Loh, Fabien Lahaille, 胡子皓

For the Robotics course of 2015, Group 13’s project, Building Blocks, has completed the basic mechanics necessary for our project. To reiterate what the project is about, it consists of programming a robotic arm to be able to locate and autonomously build a stack of blocks. It has been decided that further complexity is needed for the project, thus it also incorporates color recognition and pre-input commands to determine the ordering of the block stack. The project currently consists of an ITRI Robot Arm for the robotic arm, Lego blocks for the stacking blocks, and possibly Microsoft Kinect for the camera, although which camera to use may be subject to change.

While the basic camera has proven to be sufficient for object pickup and recognition, it may not be enough for autonomously determining depth length, and thus height, of objects. Due to time constraint for this project, however, the group may have to proceed with just a regular camera due to ease of use. This would mean that settings within the program’s code would have to be configured manually based on the operating environment, and thus render it inflexible to changes in setting. Other than that, while the Lego blocks still need to be bought, no problems have been encountered in working with the other equipment.

Object recognition through the camera is basically lifted directly from Homework #3. Some problems were encountered in connecting with the camera on the lab computer connected to the robotic arm, since it takes a little time for the connection to be established, and trying to read a frame before then would crash the program. A solution was derived to work around this problem, however, by looping until a connection has been established. Noise in the object detection were also dealt with by limiting detected object coordinates to be within the experimental operating field. This would ignore all objects outside of that field. In addition, length of the contours of the detected objects are also checked for extremities, thus removing oddities that are either too big or too small.

Mapping between robotic arm and camera view coordinates are done by simply doing trial runs to record test coordinates, and deriving an equation for the correlation. This has proven to be surprisingly accurate for our purposes, but is also a long and tedious process, and works under the assumption that the operating environment remains unchanged throughout the duration of the project. As mentioned before, this renders the project to be very inflexible to change, and is not something that can be solved within a short period of time.

The tasks that remain to be completed include procuring the rest of our equipment, handling color recognition of objects, and detecting object depth/height. Once those the first two tasks are completed, then object ordering when stacking should come easily, Depth/height recognition, however, may rely on manual configurations to resolve.