PROJECT WRITEUP: ROBOTIC ARM SORTING

Group **"RoBosort":**

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Abstract:

The goal of the project is to have the robot arm with 8 degrees of mechanical freedom recognizing objects of different color and where they are located. Once the initial phase is complete, the robot arm will sort the objects with different traits into bins as instructed. Therefore, the main partitions of the project has the following parts to complete:

1) Recognize object color. (Note: For the sake of simplicity, we've made this RGB focused).
2) Recognize the objects xyz pixel coordinates. (Note: z-coordinate is always set to 0 and changed at times according to situation)
3) Transfer the objects pixel coordinates derived from the camera to perspective of the robot's xyz-coordinates.
4) Input the above outputs to the Robot Arm.

Furthermore, the bins will be in a fixed location whereas the objects behavior will be constantly monitored and updated.

Equipment:

The required equipment we needed to complete our project included the following,

1) Decent camera that is able to detect objects clearly from at least 5ft away.
2) Bright objects with Red, Green, and Blue that can be fairly easily picked up by the camera.

Overall, our project was mainly focused on learning OpenCV and the libraries involved in moving the Robot Arm, and not so much about technical difficulties.

Deliverable and Implantation Plan:

Since we have divided the project equally as possible into 3 sub-parts such that each person can work on their part of the project without depending on the completion of a another person, we needed as a group, an comprehensive understanding of the project while effectively communicating with another throughout the given time frame.

Date: December 17, 2018.

[ ] Completely understand the project, detect and solve possible future difficulties.
Lead: Everyone Deadline: Week 1

- [ ] Make sure everyone is on the same page.
- [ ] Assigns plan of action for meeting and update on progress.

[ ] Begin first phase of the project: Outline everything.
Lead: Everyone Deadline: Week 2

- [ ] Partition the project into 3 parts.
- [ ] Create a pseudocode for each task.
- [ ] Resolve remaining technical or coding issues
- [ ] Assigns plan of action for meeting and update on progress

[ ] Camera Detection
Lead: Odbayar Bumaa Deadline: December 13th

- [ ] Camera is able to detect RGB at least 5ft away
- [ ] Camera is able to find the objects pixel coordination accurately (give or take)
- [ ] Create both still image and live detection for camera feed

[ ] Robot Arm
Lead: Josh Miltier Deadline: December 13th

- [ ] Learn the adaptability of the Robot Arm
- [ ] The robot arm will find the shortest path between its default position and the object
- [ ] Test for any bugs

[ ] Calibration and Coordination Transfer
Lead: Omar Muhammad Deadline: December 13th

- [ ] Measure required parameters
- [ ] Create a function that will alter pixel to real world coordinates
- [ ] Calibrate the function such that the margin or error is small

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[ ] Finally, put everything together
Lead: Everyone Deadline: December 16th

- [ ] Resolve any remaining coding and technical errors
- [ ] All three parts are able to function together
- [ ] Refer to the mission of the project; the Robot Arm sorts objects into bins

Demonstration:

Objects will lay in the view of the camera that will hang above the Robot Arm. In response to the camera's feed, the Robot Arm will begin to move towards the objects location. The Robot Arm will then pick up the object, and then move towards the desired bin. Finally, the Robot arm will drop the object into the bin and return to its default state, ready to pick up the following object.

Potential Issues:

Overall, because we were able to manage our project such that each person exactly new their role, and that we were communicating constantly, coordination and teamwork didn't pose much difficulty as technical issues.

For example, we spent a lot of time trying to calibrate the camera such that it can detect the object. The intensity of the light almost made everything the camera viewed appear white. We had few solutions to the this problem

1) Simply make the white pixels into 0
2) Dim the light
3) Zoom in with the camera
4) Find a better camera
5) Polarize the camera lens
6) Re-define and articulate very accurately the RGB lower and upper bounds

Measurements also posed a lot of threat to the completion of our project. The robot arm seemed as though it was always a few centimeters away from the actual objects location. Therefore, we had to re-measure and debug our code.

Furthermore, learning OpenCV and the library for the Robot Arm probably took the longest time. We were very unfamiliar with the program, and acquainting with the new platform and functions took more time than initially expected.

All in all, it was a difficult project for a three man team, but because each one of us were dedicated enough to spend time on the project, and that we didn't have as much issue with group communication, we were able to manage and deal with the stress better than expected.