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Team G, Bobs the Builders

Teammates:

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IRL05

3/19/2015

Individual Progress

Over Spring break and during this week I worked on completing vision processing code. First, I worked on getting a vision feed from the webcam. Then the image was transformed into a black and white picture where only the part was in black and the background was white. The open cv library had an image detection function to find a template image in a picture. Four different template were used and the best match determined orientation. If all the matches where bad then it is assumed that there is no part in front of the camera. All of this I completed and tested successful in different lighting conditions. The code was then integrated with previously written serial communication code so that the raspberry pi would send a message to the arduino when a part was found with information on the correct orientation.

Next, I worked on state chart design for the code we will be using in the final presentation. The code will have three different statecharts each controlling different sets of outputs. The first state chart handling getting parts to and from the camera (see figure 1.) The second state chart handles placing parts and moving the tray. The third state chart handles placing flux and wire onto the parts. Dividing the work allows multiple systems to run concurrently. I also linked the midterm presentation as well as some other documents and images to the website. The last task I worked on was writing code for Wednesday demo. The code was a simplified implementation of the part placer statechart designed to show off our ability to pick up and place parts on different locations on the tray with electromagnets.

Challenges

The main challenge this week was that most of the team was unable to work before or during spring break. The systems that I wanted to program and test were not built until the day of the Wednesday presentation. The problems seen in the demonstration were caused from last minute untested changes. Some of the rails were loose and wires had been moved and caught. We discussed the problem and now that the mechanical engineering machine shop has more hours open we do not believe it will be a recurring issue.

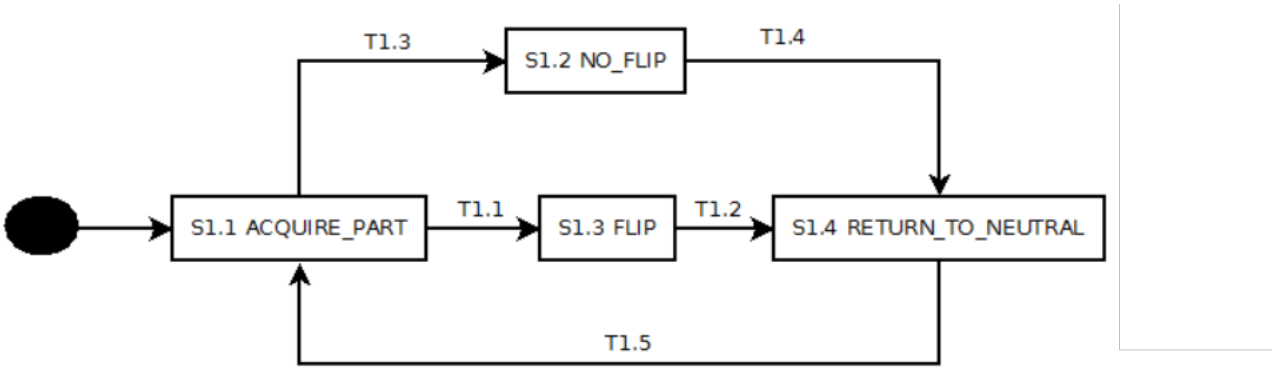
For the vision processing the largest issue is delay in the system. When it was first tested the vision processing had about a 10 to 15 second delay before the image would update. The system is only running at 1 frame per second and testing indicated that the problem was not the amount of processing needed but the way the video files from the camera were being handled. When I changed the code to create a new camera instance before each image was captured the delay was reduced to 4 seconds. At this point I am unsure as to how to improve the delay further and the open cv documentation is very poor.

Teamwork

Michael worked on building the final rail assembly which consisted of the flux dispenser and wire cutter. The dispenser was completed and the wire cutter was mostly finished. Christian worked on improving the part placer by replacing the large, heavy electromagnet we had been using with a much smaller one. Guillermo worked on code that will be used in the final system.

Figures

The statechart below defines how the vibration motor, conveyer belt, flipper magnet, and servo will be controlled. Currently some of the transitions between the states are based on time alone. We would like to change these transition to be based on sensor feedback instead.



State	Description	Actions
S1.1 ACQUIRE_PART	Move the conveyer belt until the next part can be seen	vibration_motor = on conveyer_belt = on flipper_magnet = on flipper_servo = off
S1.2 NO_FLIP	Get the part to pick up location	vibration_motor = off conveyer_belt = off flipper_magnet = off flipper_servo = foward
S1.3 FLIP	Flip the part to pick up location	vibration_motor = off conveyer_belt = off flipper_magnet = on flipper_servo = foward
S1.4 RETURN_TO_NEUTRAL	Move servo back to initial position	vibration_motor = off conveyer_belt = off flipper_magnet = off flipper_servo = reverse

Transition	Condition
T1.1	image_orientation == 3 || image_orientation == 4
T1.2	timing
T1.3	image_orientation == 1 || image_orientation == 2
T1.4	timing
T1.5	timing

Plans

Next week we will be completing the wire cutter. In our presentation we would like to be able to show a part being seen by the camera, picked up and placed on the tray, and then have flux and wire be virtually placed on the part. Also, if the part is the incorrect orientation it should rotated 180 degrees. Currently, the system that will flip upside down parts is not built and I do not think it will be complete by next week. I plan to work on improving the speed of the vision processing as well as completing the final state chart for our system. Guillermo will be writing the code for the demonstration and continuing to work on the final system demo code. Michael and Christian will be working on finishing the wire cutter and building a mount for the camera.