Individual Lab Report 09

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16-682 MRSD Project 2

Team B: Space Robot

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Individual Progress

During this week, I was still working on image comparison function for our robot's inspection. I wrote a program for the flaw detection for our test surface by using Python and OpenCV. See figure 1, the left image is the baseline of our final test surface. Our test surface will be a flat surface with only four April tags on the corners. And the right image is another view from camera. It is still the same test surface with some different kinds of flaws on it. Our robot should have the ability to detect the flaws on it.

The basic idea of the whole program of image comparison:

1. Warp the new camera image to the baseline shape and size.
2. Compare this warped image to the reference baseline, and colors the major pixels differences in red.

See figure 2, the left image is the image warped by the original camera image with flaws on it. The right image is the final result and the flaws are detected and marked with red.

Challenges/Issues

The most difficulty part for me is to figure out how to warp the image without any features on it. Because at the beginning, I was thinking that our test surface was a 3x3 meters whiteboard and there was no features on the whiteboard to help you warp the new camera image to the baseline shape and size.

And at the same time, I was thinking that what if I was just detecting the extra features on the whiteboard to detect the flaws since it was impossible for me to warp the whiteboard to have the image comparison. However, this feature detection method would be too specific to only for this situation and had no general solution to the test surface with some features on it already.

Luckily, I found a way to solve our problem to still use the image comparison method. Since we had four April tags on the corners on our test surface for the localization function of our robot, why don't we at the same time to use the features on them for helping warp the new camera image to the baseline shape and size. And the result turned out perfectly.

Cross-reference/Teamwork

Dipta integrated the Arduino IMU and Camera data to ROS system. Nate finished our new chassis design and manufacture. He assembled the whole robot with right tolerance so that our new version of the robot is much more stable then the last one. He also finished a global path planner for the robot to create the waypoints and generate path plan to reach the goal destination. Brian was working on the design of our new magnet-based attachment mechanism. One foot with 9 pieces of magnets can hold nearly 1kg. It is good news to us since our robot only has 1.5kg. It worked perfectly. Brain also gave the presentation this time.

Plans/Future Work

I will still work on the improvements of the image comparison and AR tags transform. For the image comparison part, I will work on a pipeline with Dipta. He will figure out how to use our WIFI camera to read the image then to change it to ROS images. Then I will create a “bridge” between OpenCV and ROS so that I can change the ROS images to OpenCV images. After this, I can use OpenCV images to finish our inspection for the image comparison. For the AR tags transform part, we were doing some research between AR tags and April tags last week. We found that they are majority the same. To our situation, AR tags seem more suitable for us since AR tags already have mutual ROS package for us to use. I will also finish the improvement of this part together with Dipta.

Figures

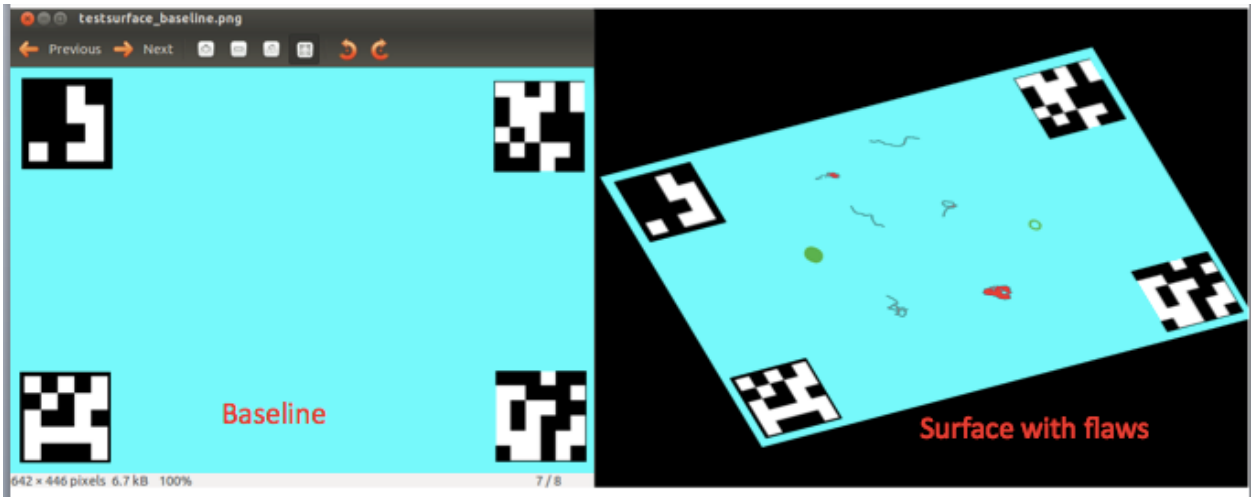

Figure1: the left image is the baseline test surface; the right one is the test surface with flaws on it

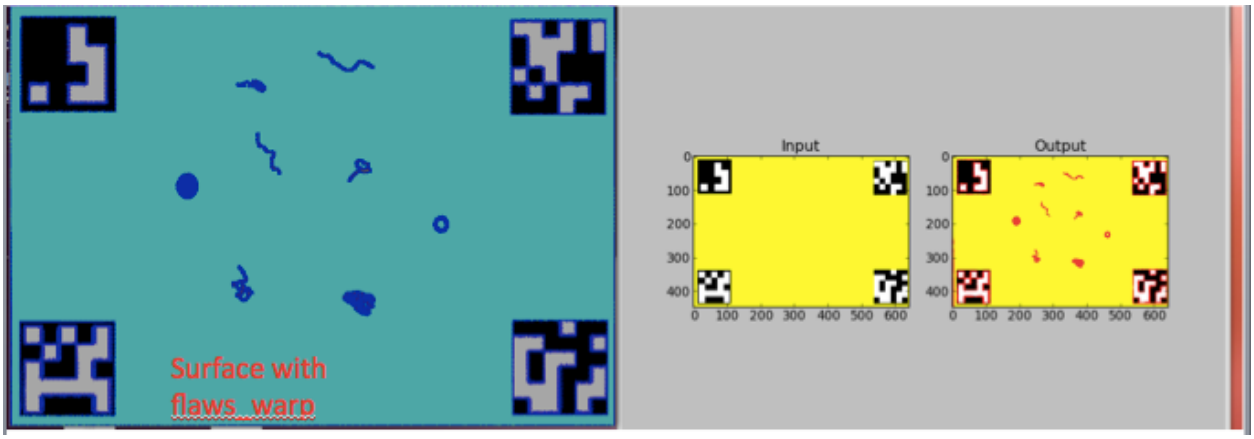

Figure2: the left image is the result after warping the test surface with flaws; the result of flaw detections after running the program