SE/CprE 492 Weekly Report

Date: 9/29/2017
Team: Dec1704
Project: Danfoss Visual Inspection System
Client and Advisor: Radoslaw Kornicki and Professor Dogandzic

1. **Brief summary of the activities in the last two weeks**

   Joey Elliott:
   I have worked on the client. I have gotten the client-side architecture laid out and ready to go. UI styling has primarily been taken care of. I've also incorporated three.js, an open-source 3d modeling project for javascript. This library is currently being used to render two 3d models, side by side. The left-hand view renders our CAD model, while the right-hand side renders our scanned version. Lastly, I've added the ability for the client to interact with our server. Right now, interactivity is limited to sending and receiving information about point clouds. However, the framework for expanding this is finished.

   Nick Gerleman:
   I have worked to create an alignment algorithm using heuristics such as matching bounding spheres to attempt a coarse alignment. Iterative closest point is being used to achieve a fine alignment. Performance optimization has been done to allow us to test more heuristics to achieve better alignment. We have achieved end-to-end testing of our process using this alignment algorithm. I have 3D printed new test objects to stress test our overall project. Code has been refactored to use STL as a mesh format for better efficiency.

   Cory Itzen:
   I started development of the server using CppRestSdk. The client performs cross origin requests with the server, requesting scans to be started, and the results sent back to the client. While the actual Alignment and Error Detection algorithms are currently in development, I have made a simple driver that mocks data to send to the client, allowing the client to test the current API calls with their expected output.

   Evan Woodring:
   I have worked on the Server side of things. I have written up the API documentation and begun method implementation. One such method is to populate the dropdown from the list of created files. I have also been researching sending an STL file as the result of a GET request for rendering in the client.

2. **Status-summary of the extra credit homework(s) that are due week#10**

   For Quasi-Homework 1, we plan to evaluate the use of SpatialHadoop for some of our error detection algorithms. We have done some initial research and analysis but have not started authoring the homework.

For Quasi-Homework 2, we plan to research and discuss topics related to the algorithms used in the Visual Inspections System. This includes KD Trees and related spatial partitioning data structures. The Error Detection Algorithm utilizes KD Trees to search for closely position points in the ideal point cloud that correlate to points in the physical point cloud. Additional tentative topics to research include the Iterative Closest Point algorithm and identifying statistical outliers. Iterative Closest Point is used to align the physical and ideal point cloud, and determining the set of statistical outliers is used to determine potential error points in the scanned model.

3. **Any exceptions that could affect the demo/presentation**

We are concerned about the quality of the camera scan that the Intel RealSense provides. In the previous semester we performed preliminary scans with both the RealSense camera and the Occipital Structure camera, and found the RealSense to be the more reliable of the two. However, the scan quality is still sub-par for what we would expect for the algorithm to perform sufficiently. The problems we have been facing include inconsistencies in the output data such as lines appearing as rounded edges, and artifacts from the environment being collected as part of the output data.

At the moment, we plan to handle this by using “cleaned” data, where artifacts are manually removed from the camera output data, and substituting this data in during the presentation.

4. **Any items more-remotely related to the project that need to be discussed**

Radek Kornicki contacted us earlier this week and mentioned that he looked into Fotonic, which is a more industrialized camera that appears to be better suited for the Visual Inspection System. It will be able to potentially provide better output data than what we are seeing with the RealSense. We are currently considering whether it would be beneficial to incorporate this into the project at this point in development. Our considerations include the cost of purchasing the camera, the time it will take to integrate it into the project, and the potential benefit it will provide over the RealSense.