Adaptive Control of Robotized Welding of Fatigue Loaded Vehicle

Overview
The weld geometry impacts the fatigue loading the vehicles experience while in use. In order to improve the weld geometry, Volvo Construction Equipment wants to determine whether it is possible to adapt a welding robot to enhance weld geometry output. Being able to adjust automatically will improve the quality of the welds because the robot can adjust for defects in real time.

Objectives
The objective of the project was to determine if it was possible to read weld geometries using image processing. Our work will play a larger role in a system that includes a robot that can be adapted based on the image processing.

Approach
- Researched the current robot system with scanners that is currently used
- Learned about Volvo Construction Equipment quality standards for welds
- Developed concepts that have a controller that is connected to the robot
- Selected a Raspberry Pi as the controller because it had the required components such as an Ethernet port and multiple USB connections. The Ethernet port was necessary because the robot can only connect to another system with an Ethernet cable.
- Researched Image Processing with MATLAB. We used MATLAB because the team only has experience in MATLAB.
- Tested functions of image processing techniques on pictures from the internet. The test functions include the Hough Transform and the Region Properties.
- Tested the Raspberry Pi with an actual weld sample.
- Designed and 3D printed a case to protect the Raspberry Pi components.
- Conducted a linear regression analysis on the data set to try to create equations for machine learning. The data set was determined to be too small.

Outcomes
- Determined that image thresholding is a difficult process that can take up a lot of time. This time will affect manufacturing time
- The ABB Robot has its own unique coding language that must be used and adjusted. Chalmers University of Technology students are exploring this further
- Images can be read by a code a Raspberry Pi. These images can have critical geometries read and compared to the quality standard.