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Sundance Weekly Progress Report Week 9	
18.12.2022	

1. Previous Week's Overview

Last week, we worked on preparing the test documents for each subsystem. We planned a test procedure for each of the subsystems which also helped determine the initial implementation requirements of the subsystems. We also made further research and experimentations for the subsystem design. Different mechanical actuation methods and mechanisms are thoroughly investigated, as well as various image processing methods used in edge detection. Finally, we ordered the necessary components required for the subsystem implementation

2. This Week's Progress

Coverage Detection
This week, we continued to develop a coverage detection algorithm using opencv. We tried different algorithms and decided on one of them. Comparing two images with and without a shadow, we detect the shadow of an object and we draw a rectangle around the shadow we find. Furthermore, to eliminate unwanted contours, an algorithm that can detect the largest rectangle in the image is developed. In addition, we wanted to test our algorithm with different images instead of relying on the same, small amount of images. Therefore, a camera will be used to take images and process on live. All these functions are created without machine learning. It is realized that only image processing comes with constraints and it does not work as expected. As a result, we started to work on learning based detection algorithms to improve our coverage detection capabilities.
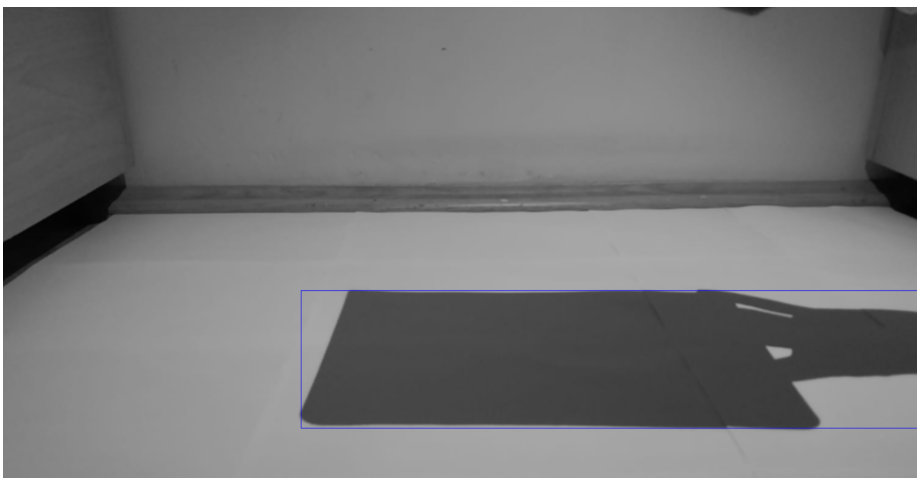
Actuator Design, Part Production, and Assembly

The actuator which consists of three actuation systems is designed as an example. Two different actuation methods are used which will enable us to compare and select for our design. The first method is belt drive, it consists of a belt and a motor to translate rotational motion into translation. Second method is trapezoidal screw drive. These two methods will be compared in the test demo in terms of the force it can carry and the speed of the end effectors. The test document is to be updated to suit better for the actuator tests. The 3D drawing of the system can be seen below.
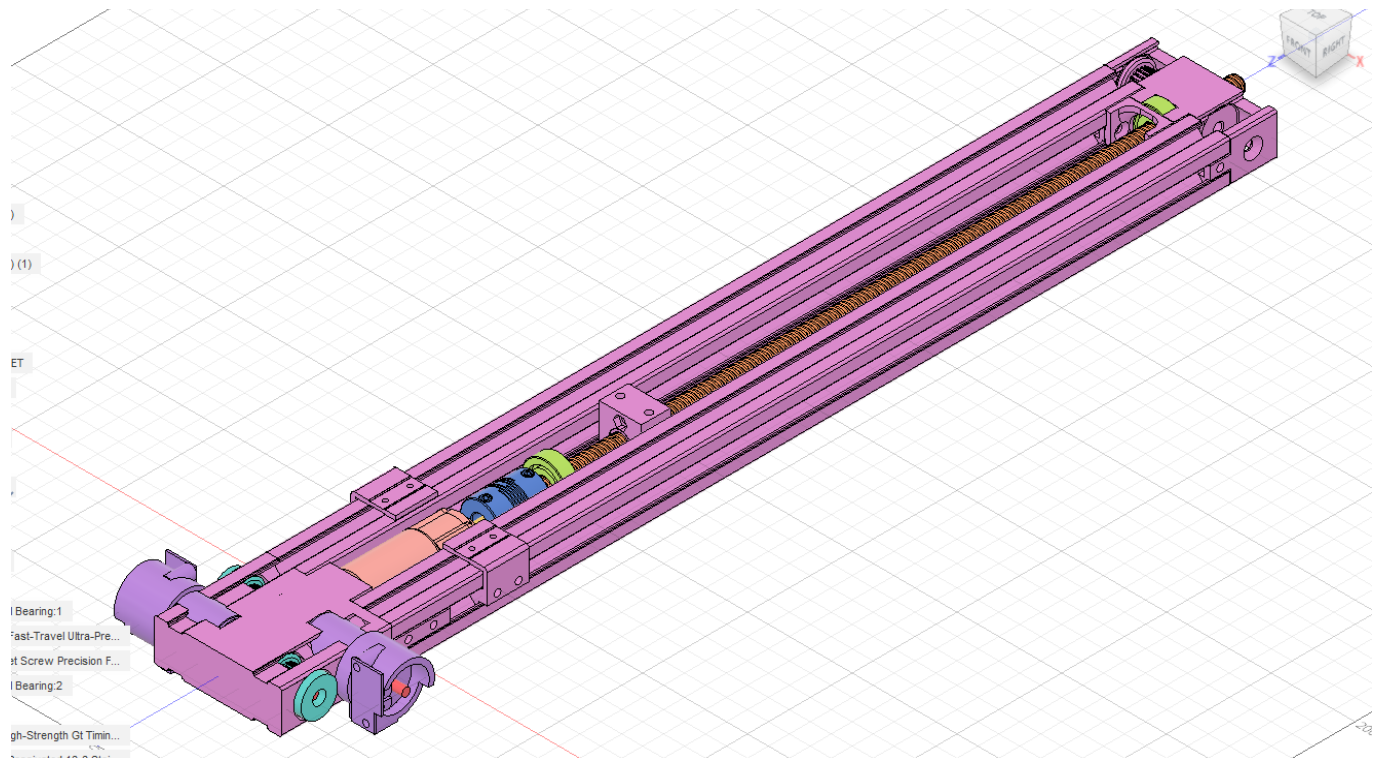
This week we also started to manufacture the components and assemble the construction. The actuation and closed loop control is to be implemented in the early next week. A conceptual demo construction is also planned to be manufactured to exhibit on the demo day.

3. Next Week's Plan

Next week, we have the module test demo, hence we will finalize and polish our subsystem implementations. We will also update the test documents considering the updates in the subsystem designs.

We have the actuation system ready, and we need to proceed by adding the final joints so that we can simulate an example movement in 2D for the final implementation, with 2 DOFs. Also, we need to program the microcontroller to control our motors using PID. Finally, we will prepare some tests to plan our test sheet for the actuation and control subsystem for the test demo.

For coverage detection, the image processing algorithm is still sensitive to changing environmental conditions such as light intensity, floor color, irregular shadow patterns, etc. We realize that more advanced image processing techniques could be used to perform better operations. Hence, we will further improve our image processing algorithm as much as possible. Then, we will implement it using a computer and a camera to process real camera images during the test demo. Finally, we will prepare a test sheet for the coverage detection system and test our subsystem in the demo place with real camera images so that we are ready for the test demo.