Work Completed

This is the first week of writing and a lot has occurred over the first few weeks. Over the summer I completed the machine shop class in the May which now allows me access to the various machines. The first week of class team 4 reviewed the parts order list and went through what we had actually received. We had in our possession a DC motor, HDPE rod, vicryl sheet, AC adapter, springs, and a small protoboard. A big problem we had to deal with was the fact that our design for the monitor lift was not going to work and that we had to come up with a new idea.

The first class on Friday I set to finding a new means to lift the monitor off the ground twelve inches. Within the senior design lab was a linear actuator which seems to be a perfect fit to our project.

During week two I contacted a company named Firgelli auto who specializes in such devices as linear actuators and linear guides. After talking with a representative at the company over the course of the week we decided that a linear guide was not suitable for our design because it would need constant power supply to the guide to keep the monitor elevated and there was no way of getting the monitor down without it crashing to the floor.

The latter part of week two was devoted to finding a new means of lifting the monitor. With the help of Dan Zach’s we tested a linear actuator and various motors in the back room of the laboratory. We were able to get the linear actuator to work but noticed that the guide would tighten down on itself every time it reached is upper and lower limits. I then contacted Troy Newton of Firgelliauto and discussed with him the use of linear actuators and told him the problem we had. We were instructed that the linear guide we had did not have any limit switches and that was the reason for the problem. After consulting with Troy we decided that a 400 lb linear actuator with internal limit switches should do the trick for lifting the housing unit and the monitor twelve inches of the ground. Below is a picture of the linear actuator.
With the week ending in the purchasing of this linear actuator it was time to focus on the paint cap removal aid. Upon testing of the motors torque it was concluded that it would not exert enough force to open the lid of a paint cap. Another motor was ordered at the beginning of week three and we are awaiting its arrival. I then turned my attention to the adapter piece that was to be attached to the motor head. Dan Zach's and I took the rod of HDPE to the machine shop and cut three quarter inch and one inch pieces creating dummy slugs for the creation of the cap remover. Our next problem that arose was trying to get the negative of the paint cap inset into the HDPE. We needed a way to insert the imprint of the cap into the HDPE without compromising the rest of the short rod piece.

Over the weekend and beginning of week three I devoted much time to the idea of creating this small essential remover piece. I performed various tests with different setting substances and found that the best idea was the use of a high strength epoxy. I then tested many times with the high strength epoxy and found that if I was to gain the desired imprint in the epoxy that I was to remove the paint cap that was inset before the epoxy fully set and was to hard to remove. The procedure for the epoxy mold is below:

1. Create basin in the shape of final removal piece  
2. Mix epoxy’s dual elements  
3. Pour Epoxy into basin and let sit for 30 seconds  
4. Insert paint cap into epoxy  
5. Let sit for 15 minutes  
6. Remove paint cap/ basin mold  
7. Let sit for 24 hours to fully cure  
8. Shape piece with grinding wheel
After many trials and various materials tested the above method was deemed to the best resulting in the highest accuracy of mold as well as the highest strength and durability. The reason for the above process was to introduce the cap into the epoxy while it was somewhat tacky and then let it sit so as to gain a well defined negative of the cap. Once the shape was achieved it was time for the cap to be removed from the epoxy before it was permanently affixed to the substance. If the cap was left in too long the means for retrieving the cap resulted in deformation of the inserted cap imprint. Below is a picture of the paint cap removal aid in which the epoxy set imprint will take the place of the HDPE slug in place now.

![Figure 1.2- motor depicting placement of epoxy set imprint](image)

**Future Work**

The remainder of this week will be devoted to obtaining a final paint cap removal aid piece constructed of epoxy. The main objectives are to gain a repeatable imprint in the epoxy as well as designing a desired basin shape that will adapt to any motor we get. The next problem is how the epoxy piece is going to be mounted onto the motor head. Perhaps we will have to drill the epoxy in the middle and then pressure fit the motor head to it. Another way to attach the motor to the removal aid piece would be to place the motor head in the setting epoxy so as to gain a permanent bond. The problem with setting the motor into the epoxy is that it is permanent and you only get one shot for it to be perfectly aligned and centered.
Hours Worked

In Lab: 4

Out of Lab: 10

Total Hours Worked: 14