Painting Solutions for Limited Mobility
Week 11: April 6, 2006 to April 12, 2006
Noah B. Leff
Team #1
BME 291

Work Completed
The 11th week was reserved for testing both of the prototypes and making any final, last minutes changes. The majority of the week was used for testing both designs. The arm support was mounted to the wheelchair in the lab and many variables were tested. First, the vertical adjustment of the device was tested. Different subjects of varying heights sat in the wheelchair and the arm support was vertically adjusted to each person. While doing this, we noticed a flaw in our design which was subsequently addressed. The “uni-bearing” linear slide used to create vertical movement began to bind when weight was put on the arm support pad. This binding caused difficulty when adjusting the vertical height of the arm support.

We came up with many different ideas to address the binding of the uni-bearing linear slide. Our first idea is to replace this type of linear slide with a double-flange linear bearing. Instead of mounting to the 80/20 on one side (hence uni-bearing), this type of linear slide mounts to the 80/20 on three sides. We feel that this type of mounting will prevent the vertical height adjustment system from binding. Our second idea is to utilize two uni-bearing linear slides, one on the top outside, and one on the bottom inside of the vertical adjustment component. This type of attachment would prevent binding; however, it will add unnecessary weight to the overall device. On April 12th, we plan to test both options to see which will work best.

During the testing of the arm support, we also tested the horizontal adjustment of the device. Horizontal adjustment, or otherwise known as rotation, is achieved by use of straight pivot arms and living nubs. The subjects’ arm was placed into different locations, and the support system was horizontally adjusted to these locations to support his/her arm. While doing this, we noticed another flaw in the design. When the arm was placed on the support pad, there was some flexing between the straight pivot arm and the living nub. To fix this, we incorporated two straight pivot arms, as opposed to the previous design with only one. One pivot arm was placed on top of the 80/20 and one pivot arm was placed on the bottom of the 80/20. This new design prevented any flexing between the pivot arms and the living nubs.

The paintbrush/marker wrist attachment device was also tested during this week. Each individual constituent of the device was tested, and then the device was tested as a whole. First, the unit used to hold the paintbrush or marker in place tested. Different size drawing utensils, ranging from small pencils to large markers, were placed in the device and locked in place using the wing nuts. While doing this, we noticed another flaw in the design. With large markers in the holder, there was no problem; however, when smaller drawing utensils, for instance, pencils, were placed in the device, the wing nuts would hit against each other, making it very difficult to lock the utensil in place. To fix this, a whole new holder unit was constructed. Smaller wing nuts were needed, therefore,
smaller holes had to be drilled and tapped into the holder unit. A new unit was fabricated, using smaller wing nuts, and the problem was obliterated.

Next, the holder unit was securely fastened to the PVC base, and they were tested together. Two extrusions on the bottom of the holder unit fit into the holes in the PVC base, locking the holder unit in place. The whole component was mounted to a wrist guard, and attached to a subject’s wrist. While using the device to draw, different marker angles were tested. During this testing process, we noticed that it was difficult to lock the device in certain positions. This difficulty was from the extrusions on the bottom of the holder not fitting directly into the holes of the PVC base. To fix this problem, some of the holes in the PVC base were widened just enough to allow the extrusions to securely fit into them.

Future Work

Although the project is relatively complete, there are a few things we plan to do in the next week. Aesthetics, as well as final run-throughs, will be our main focus during the next week. There can never be “too much” testing, so we plan to test both prototypes again, using different people, to ensure safety, and to also guarantee both designs work properly. We plan to clean up all aspects of our designs, so that they can be delivered to our client in a clean fashion.

As our design sits now, everything is put together and we have two complete designs. We plan to break down both designs to the smallest possible parts, and reassemble them. This will be done so that we can add Lock-Tite to all the screws, nuts, and bolts to prevent them from loosening from vibrations. Also, this will ensure that all the screws, nuts, and bolts in our design will be securely fastened.

Project Review

Our project is relatively complete. As mentioned above, we do have some areas which we plan to address in the next week, but these areas do not affect the outcome of the project as a whole. Both aspects of the project, the arm support and the drawing utensil wrist attachment device, meet the needs for our client, and will provide him with a better drawing atmosphere. At Passion Works, they were looking for an arm support device to support our clients arm while he was painting. We constructed a device which will support his arm in many different locations while he paints. They were also looking for some device to attach markers and paintbrushes to our clients wrist, instead of tying them. We constructed a device which will attach a drawing utensil of almost any size to our clients wrist, which also adjusts to many different angles.

Hours Worked

Hours spent on the project during Week 11: 14.00