Weekly Report

This week saw a myriad of tasks taken on by myself and my group, along with which came a myriad of accomplishments. The first item tasked this week was the building of our plastic box. This was the first item which we had prototyped where the physical object matched indications of what the prototype images predicted it would look like. The box had dimensions 30 cm x 80 cm x 20 cm, and was made out of a thickness of ¼” plexiglass. The box is very sturdy, and will support the various weights and attachments which it will incur during the design and conduction of this experiment. The glass was cut using various tools and support from the fine folks at the machine shop. The glass was cut by placing it on an automated slide which slid the glass across a saw, keeping the glass in place to get an even smooth cut. Furthermore, after the cut was made, we took a polish tool and smoothed out the edges.

After that, the next task undertaken was hooking up the relay properly. The relay had 8 pins on its surface, and the diagram associated with the 8 pin setup was fairly confusing. Upon attempting to wire it on my own was less than a successful operation. The reason for this is I had no idea where to begin and wasn’t sure which hook up went where. A meeting with Dave Price greatly furthered my understanding of how the hookup properly worked and how it should have been properly aligned. The setup came with 8 pins arranged in a sort of matrix. 2 of the pins were separated from the other 6 by a greater distance, and seemed to be different pins which would probably perform a different function than the other 6 pins. As it turned out, these other 6 pins had the function of working with the AC output, and those separate 2 pins were DC inputs. The main thing I had to learn was how the relay operated first of all. I was under the impression that the relay was a super transformer which converted DC volts into AC volts. Also, I thought the relay had a second function of voltage transformation which increases voltage by a quantity in this case of 24 times the input voltage. It turned out that rather than increase the voltage, the relay output was outputting a voltage which had been inserted into the relay at a different input. The relay has a 120 V AC input, which has to go into the terminal of the “hot wires.” This is the input where the AC Voltage enters, but remains in the inactive state until otherwise indicated. The relay will be shut off, until the DC source indicates otherwise. The DC terminal consists of two leads, one of which will be a ground, or 0 V lead, and the other a live wire which will have a 5 V lead. The difference potential created at these two leads will be 5V. Also, though, it is important to note that configurations exist where the 5V lead can coincide with another 5V lead and that both these configurations can operate the relay successfully. The next step is understanding what the physical change the relay undergoes when the DC lead on it signals it to be excited. A wiper slides down from the top bar, and activates the bottom bar. Therefore, instead of outputting no voltage, it outputs the same auxiliary input from the AC hot wires! Because of this, the output of the relay can be the desired 120 V AC which we need to activate the pump. Having the lead from the relay go into the DAQ in LabVIEW, LabVIEW can be the ultimate source of controlling when the relay is on. Having the relay connected to the pump is the final step in having the relay control when the pump is on, which is the final goal of this wiring and configuration set up. In order to set up and connect all these separate electrical elements, a soldering job between the stray
metal parts was necessary. All spare metal clips were soldered together using the soldering gun available in the Senior Design lab. Because of these efforts put in this week, the relay is now controlled by LabVIEW, and outputs 120 V AC to the pump, which then controls whether or not the pump is operational.

The next problem we encountered this week was acquiring out force transducer. Upon receiving our order form for our target part, the office rejected ordering citing the reason as having no idea what the voltage inputs and necessary current values running through the device is. We returned to PASCO’s website for details pertaining to how the part should be correctly operated and searched for the details which were apparently requisites for ordering parts through our department. Unfortunately, PASCO did not divulge this information on the internet through their website. We were confused by all this, and consulted with Dave Kaputa as to whether or not this product can be used at all. As far as a force transducer, it had many advantageous benefits, including primarily that it had a reading range of less than 50 Newtons, which is the relatively high degree of accuracy which we need for the purposes of this experiment. We were told that it outputs voltage just like any other software, and that because it does this, it can be compatible with any voltage readers that detect signals, such as a standard data acquisition assistant in LabVIEW. I called PASCO searching for more details pertaining to this device, and was fairly disappointed with the response that I had received from them. At first they told me that the reason this information had not been added to the documentation sheets of their product was because they had chosen not to make this information available to the public. The purpose for their secrecy on the issue is they wanted to maintain that their product would only be compatible with their own product so that if somebody intended to use one, they would be forced to purchase the other as well. Furthermore, they decided to thwart the exact process which we were attempting to use their device for. Fortunately, we were offered an alternative from their website. The sales associate was very helpful, and suggested an alternate force transducer with the same sensitivity that operated within the same range. This transducer is model number CI-6746, with an 8-pin analog plug. Unlike its fancy-pants counterpart, the specifications of this older model were made public on PASCO’s website, allowing for us to use it in conjunction with any alternate decoding program we so choose. In our case of course, the only program which we need to worry about compliance with is LabVIEW, which we will use to read the output from this device and then place this data against that collected from the velocity data to determine our force-velocity curve.

Another work completed this week was setting up the hinge structure which will go with our stainless steel piece. Using the drill made available to us in the back of the senior design lab, a tiny hole was drilled through both ends of a stainless steel hollow cylindrical rod which will act as our lever. Because of the strength of this device, the hole was drilled clean and allowed for free rotation of the lever about a pin hinged through it connected onto some stable 3rd body in static equilibrium. This metal piece is now hinged to the plastic body, though the hinging was not work on this project that I am responsible for.