The Device:

The automated syringe loading device is an aid for diabetes patients who live with common conditions typical of the disease. These conditions include, but are not limited to, arthritis, hemiplegia, Parkinson’s disease, tremors, neuropathy, and vision and hearing impairment. The device will assist these patients by filling syringes with their required dose of insulin. To operate the device, the user will input the amount of insulin required, and the device will then fill the syringe to that amount within a tolerance of 1/1000th mL. To make the device more user friendly, it will hold any size insulin bottle, store up to 10 syringes for loading, and alert the user when the current bottle of insulin is near empty. For the doctor’s records, the device will also maintain a time stamped account of the volume of each syringe filled.

Work Completed:

This week, the team was able to finalize the design of the cartridge swing arm (Figure 1). We obtained the parts we needed for the construction and, using the dimensions of the case, cartridge, and available components, the length of the guide rod and the position of the stops were determined. The parts we obtained were the clips and collars from a collapsible umbrella (Figure 2).

Figure 1: The Cartridge Swing Arm. The pictures show the cartridge wing arm from different angles.
Also this week, the design of the frame was completed. We were informed by Dr. Enderle about the company 80/20, and he suggested we look into them for possible components of the frame. While the company has a great product, their inventory does not stock anything that will be small enough for our needs. However, the idea of adjustable components was not lost on us, and the frame we designed will utilize this method. The bare frame can be seen in figure 4, and an example of the adjustable rail can be seen in figure 3. The adjustable rail will use thumb screws to hold it in place until the final location has been identified. Later, the part can remain in place with thumb screws or be drilled and bolted in place for a more professional and finished look. The joints of the frame will also be held with nuts and bolts. Using these should cut down on the assembly time, as welding aluminum is very time consuming.

Figure 3: The adjustable rail. The thumb screw on the right will secure the rail in place while providing easy movement during installation and when changes have to be made.
After seeing the performance of the stepper motor, it was obvious more power was needed. To remedy this, a power circuit is being designed. The design began with the known voltage output of the PIC (7 volts), and the amount the motor needed (12 volts).

**Future Work:**

Next week we will be buying parts to build the frame. We will need 90 degree angle aluminum stock, some thumb screws, and a few nuts and bolts. With the design we have now, the frame should only take about a day, and will require only a hacksaw and a power drill. Both of which are available in and out of the machine shop. After the frame is built, the swing are will be pieced together. This will require a fair bit of drilling and cutting, but should come together pretty easily. The only parts needed for this are a metal tube, some pins, and some springs. These are available at Mansfield Supply, and will not take long to get. And now that we know how the swing arm will go together, the cartridges can be finished with the clips and gears. We
needed to wait until we knew how big the guide rod holes would be before we could drill the cartridges. The center hole will be drilled, and several more will be drilled around it to remove some of the cartridges weight (they are solid aluminum and are quite heavy for their purpose).

Since the whole device revolves around the motor turning a lead screw, the power circuit will have to be built within the next couple of days. This will only require a few circuit components available in the lab, and no parts should need to be ordered.

**Project Review:**

This week, our focus will be on the motors and the frame. Now that they are coming together, they should not require much time, and attention can move more towards the programming and testing of the device. We are leaving some finishing work until later, but this will allow us to find problems now, and adjust for them before it is too late.

**Hours Worked:**

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