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 1/1000thmL. 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:

Last week we built and tested the motor/lead screw assembly. This is shown in figures 1, 2, and 3. The rig is made out of wood, and is meant only to test the functionality of the device. After applying the motor and switching it on, we found that our design worked, but would need some tweaking. The motor was turning the lead screw too slowly. It would take several minutes to load one syringe. To remedy this, we determined how fast the lead screw would need to turn to load a syringe in an acceptable amount of time. We set our time limit at 30 seconds, figuring most people would not want to wait any longer than that. Then we calculated how fast the lead screw would have to turn, and compared that to the speed of the motor. Using this comparison, we were able to figure out how much to magnify the motor’s movements using gears. The gears were selected and assembled in CAD to make sure everything could be fit together well, and prevent wasting materials. The gears we had worked perfectly to build the design we came up with, shown in figure 4, but the end result was failure. While we did calculate the power required by the gears, and found it to be within the manufacturer’s estimate of the motor’s limits, the motor wasn’t strong enough to turn the screw at the speed we desired.

The frame for the inside of the case has begun construction, but it will need to be modified slightly if a new motor will be used in the device.
Figure 1: The syringe before filling
Figure 2: The syringe after filling
Figure 3: A close-up of the device
The documentation for the Bluetooth module has arrived, and it’s operation is being studied. This is done only when other work for the day has been exhausted, since it is a component that may or may not be used in the final design.

**Future Work:**
Literature on the older stepper motors has been requested from the manufacturer, and should be in shortly. Once this arrives, we will be able to test the device with this motor. Also, the internal frame will be built, along with the new assembly for the larger motor.

**Project Review**

The mechanical aspects of the device have hit some snags, but they are being dealt with quickly. Also, progress with programming is moving at a steady rate, and some testing between parts and programs should begin soon. Hopefully, the new motor will be running by the end of next week, and the final frame can be put together.

**Hours Worked:**

- CAD - 6
- Machine shop – 10

  Total - 16