Project Identity:

Team 2: Automatic Syringe Loading Device    Week 12    4/15/08    Scott Relation

Work Completed:
Integration of the voice recognition module with the microcontroller continued. The three main issues involved with this were: accurate detection of spoken phrases, the correct reception of the voice recognition module’s output at the PIC24’s input pins, and the ability to clear & reset the voice recognition module for reception of the user’s next input. Phrase/word detection success appeared to vary significantly from word-to-word; some words were correctly interpreted roughly 90% of the time, while others were successfully received around 30% of the time. As expected, speed, pitch, and inflection of the words all played a role in the module’s successful interpretation of speech; however this was even more the case when the words involved were shorter in length, (for instance, interpreting single syllable digits; “one” and “two” vs. “seven”). Recording multiple versions of these words increased accuracy, but it may be impractical given the limited memory we have for storing words. Switching to using fewer, but longer words for menu items may yield better results, (use “increase” or “plus ten”, instead of specifying digits individually).

In receiving output from the voice recognition module at the PIC24’s input pins we had voltage issues. When not connected to the main circuit the “high” output for the VR’s pins is roughly 3v. However this can drop sharply once they are connected to the microcontroller, sometimes going as low as .8v; which is below the PIC24’s threshold for receiving a “high” signal. Using new batteries for powering the voice recognition module and microcontroller made some difference initially, but output voltage would quickly drop out of acceptable range. We are currently looking at using “pull up” resistors on the output lines to raise their voltage. Initial results seems promising, however further adjustments need to be made; currently the addition of these resistors is affecting the current/voltage of other parts of the circuit, resulting in communication errors with the LCD screen, etc.

Previously we were looking at triggering the voice recognition module’s input pins using transistors to mimic key presses to clear & reset it after output had been received by the PIC24. Initially this appeared to work, but after repeated tests its reliability came into question. Currently we are using a relay to control power to the module; following data reception the module is shut off and restarted.

I also assisted with the creation of a prototype for the syringe cartridge (see Fig. 1) which could be used to hold both sizes of syringes securely and could be rotated by using a servo to turn the gear mounted on its bottom. This prototype was meant to stand in for the actual cartridge which is still in the process of being machined; its purpose is to aid in testing the other device subunits, to initially test our overall approach to filing syringes, and to serve as a reference in positioning components within the device frame.

Figure 1 – Syringe Cartridge
In order to test the drawing of the syringe plunger I constructed a frame for the plunger assembly, (see Fig. 2). This frame supported the stepper motor, gears, lead screw, and plunger claw. As with the syringe cartridge prototype, this frame was meant for use in initial testing only; a more professional frame will be created once any design issues are resolved. Testing of the plunger claw’s motion went well, although its speed was slower than was expected; adjustments regarding that though should be able to be quickly made by changing the gear ratios. Problems did arise however when using the plunger assembly to push/pull an actual syringe’s plunger. The motor lacked enough torque to turn the lead screw under load. Changing the gears and increasing power to the motor didn’t result enough increase in force to move the plunger.

Faced with this outcome we began looking at using a different motor. Initial tests with the 5023-990 stepper motor from Applied Motion (see Fig. 3) seem favorable; it appears to have all the torque we need to turn the gears/lead screw. Adjustments to gear ratios will most likely be needed to ensure that we can control the lead shaft rotation fine enough to meet our accuracy goal.

Future Work:
I will continue working on the interface circuit for the voice recognition module and will proceed further with the menu program for the device. I will integrate the sensor inputs into the main circuit and connect the various motors to the PIC24’s output pins. I will assist Dan & Kathryn in further assembly and testing of the various subunits and aid in any adjustments that are needed to existing designs.

Project Review:
Mounting and testing of the various subunits has begun. Adjustments are needed to ensure that all the necessary components will be able to fit within the device frame and case. Work needs to begin on a power circuit for the device. PCB specifications need to be finalized by the end of the week. The menu program needs to be completed within the next few days; full testing of it to prepare insulin dosages needs to begin as soon as possible.

Hours Worked: 31 hrs