Project Identity:

Team 2: **Automatic Syringe Loading Device**  Week 10  4/1/08  Scott Relation

Work Completed:

I continued working on the menu program for the device; looked further into using arrays to store menu prompts, setup screen navigation, etc. I researched how to modify menu prompts on the fly, (through concatenation of strings, inclusion of numeric values from variables using the sprintf command, etc.).

I started working on communicating with the sound output module. I was able to initially test the chip using a console program that was provided by the manufacturer. The program used a serial (UART) interface to send volume, speed, and pitch settings to the module, along with the text to be outputted using the it’s synthesizer. There were several difficulties in establishing direct communication between the PIC24 processor and the sound chip. Many transmission errors were caused by the module not being supplied with enough current (80mA). When operating at a lower than suggested current results can vary greatly from test to test. The module can even become caught in a processing loop, causing it to ignore inputs from the PIC24 and output speed in an endless “stutter”.

Another transmission error was caused by data being sent too quickly to the sound module. The SP03 is configured to reply back to each byte it receives, in order to verify that the data has been read correctly. If you try to write to the chip while it is “talking back” your data will be lost. You can wait for & read responses to data transmissions or you can modify your “send” code to incorporate a delay after each transmission. By using delays after transmitting each byte I was able to successfully send commands/text for speech output. Because I choose this method, and reception of data isn’t necessary, I do not need to dedicate a pin for UART reading. This frees up the pin for possible use with another device.

I started looking at how I^2C could be used for communicating with the sound module. There is one more system component that will need to use an R-232 interface; since there are only 2 UART modules available on the PIC24, and one of them is already being used for sending data to the LCD screen, I^2C communication may be the only option which will allow us to operate all the components at the same time.

I also built a servo power/control circuit, (see Fig. 2), for Kathryn to use in testing the movement of the bottle holder assembly. The circuit is operated using two switches; one for turning on the servo and the other for specifying whether the servo should turn clockwise or counter clockwise.

![Figure 1 – Daventech SP03 Text-to-Speech Module](image-url)
By removing the servo’s “gear stop” I made it possible for it to be operated in continuous rotation mode.

![Figure 2 – Servo Power/Control Circuit](image)

I also created a mini-test circuit to see what the effect of amplifying the voltage to the stepper motor’s leads would be. In previous tests the motor did not have enough torque to turn the plunger assembly’s gears. The typical lead voltage during the tests was approximately 2v. Amplifying the lead voltage to be approximately 10v seemed to dramatically increase the torque of the motor. In light of this new information we will keep our current stepper motor and will redesign its driver circuit to provide it with the necessary voltage.

I also attempted perform troubleshooting on our LCD screen; it stopped working normally, displayed odd patterns, and defied attempts to communicate with it using the PIC or the computer. I called Matrix Orbital and attempted to work with their tech support to try to resolve the problem; we were unsuccessful. They have agreed to take a look at screen, and will try to repair and return it to us. The will not supply a replacement for it while the repair work is being done.

This week I found and purchased lever switches which can be used as sensors. These switches respond to pressure applied to a 3/4” lever. Once sufficient pressure is applied, a button is depressed and the switch is closed, allowing current to flow through it. These switches can be used to detect the presence and size of a syringe, the presence of an insulin bottle, and can be used to signal when the bottle holder caddy has reached the tip of the syringe’s needle.
**Future Work:**
I will continue working on the menu program. I will attempt to establish I²C communication with the sound output module. I will work with Kathryn on the voice recognition module, attempting to improve its accuracy through the use of its “speaker independent” mode of operation. I will also begin looking at how to best receive input to the PIC24 from the voice recognition module and the various sensors of the device.

**Project Review:**
Motor operation is the focus of this week; we hope to be testing & finalizing our designs for the plunger claw and bottle holder assemblies over the next few days. Initially assembly of the internal frame of the device should be completed this week; once it’s built the various sub unit sections can be mounted on it and tested.

**Hours Worked:** 27 hrs