Work Completed

Over the course of the week I stumbled across a sensor that could be used as the device “tilt” sensor. The purpose is to ensure that the device is sitting in an upright position before attempting to fill the syringe with insulin. This is an important aspect because we will have to make sure that the user will not be receiving air in their syringe. Any air would mean that the syringe isn’t filled to its required amount and the person would be, unintentionally receiving an incorrect amount of insulin. Therefore, this could lead to a potentially dangerous situation for the user of our automated syringe-loading device.

Two types of sensors were researched. One was the mercury switch and another is the rolling ball switch. The mercury switch, Fig 1., does seem to fit the project well, including its accuracy and simplicity, however, knowing that some may be leery of using anything containing liquid mercury I made sure to look for alternatives.

The advantage to the mercury switch is that it is much more accurate. It can be used to either allow or interrupt the flow of electric current in a circuit in a way that is dependent on the switch’s physical position or alignment. When positioned in the correct “upright” position set by the device also being in the “upright” position, the bead of mercury contained in its glass frame touches two sensors and therefore completes the circuit. Switches designed in a similar manner, but not including mercury, are rare because of their sensitivity to shock and vibration, leading to false tripping. However, since we do not intend for the device to operate unless it is sitting on a sturdy, flat surface we feel confident that the level of accuracy required will not be high. Therefore, a switch such the rolling ball, Fig. 2, seems to fit the device requirements to a higher degree.
Figure 2: Rolling ball tilt switch

The rolling ball tilt switch can work by using an optical method. As seen in Fig. 3, when the sensor is in the “flat” or “resting” position the ball is in the lowest most point and the infrared LED recognizes it’s presence. And seen in Fig. 4, when the sensor is tilted by a certain degree, the ball is out of the infrared LED’s path. Most sensors are able to determine the tilt angle, however for our device this is unnecessary because we only need to know if the device is resting flat. If it isn’t, then we can program it to warn the user and not function mechanically.

Figure 3: Resting flat  Figure 4: With tilt angle

Also accomplished this week was the research on the voice output. Voice output is necessary because the voice recognition hardware chosen does not provide voice output. The voice output is required for the device to properly request input from the user. This is another important aspect for our device to work with visually impaired users. After last week’s meeting with Dave, he suggested the device that Team 7, the MEDSense team, is using which is the Daventech Speech Synthesizer, SP03, Fig. 5.

Figure 5: Daventech Speech Synthesizer
After meeting with one of their team members specifically working with the device, Chris Falkner, it was decided that it does seem to fit our needs and within our budget. It is slightly less expensive than the voice output device previously considered and since another team has already begun their project using it, they can serve as a resource for us.

One feature that the SP03 would provide to us is the three different interfacing options. I²C, parallel and RS232 are enough options for the Scott to choose which will be best for communication. It stores up to 30 phrases (with up to 1,925 total characters). It will correctly pronounce anything that is sent to it, including numbers, which is especially important for our device to communicate with the user. Additionally it has a PIC processor that will make it easy to communicate to the host processor that Scott is working on.

### Future Work

Hopefully this week the voice recognition hardware, SR-06 by Images Co., will be received. I was able to save the team about $40 by purchasing the unassembled version of the device. With the soldering practice given from last semester’s EKG project I felt confident that I would be fully capable of correctly soldering the SR-06. Additionally, after researching online what other purchasers had used their SR-06 for, I was able to come across many sites with step-by-step instructions of how to put the device together. There are also a few sites that had video instructions. Although video does not seem like it will be necessary, it is encouraging to see the simplicity in soldering the device.

Also this week, the voice output will be ordered. After speaking to Team 7, MEDSense, it seems as though if there are any complications in communicating between the microprocessor and the SP03, we will be able to collaborate on solutions. Therefore, in the next week the part will be received and testing of it will begin.

### Project Review

For me, again, this week revolved around the additional devices that will need to be ordered. I am anxious to receive the voice recognition and the voice output devices to experiment with the capabilities and also learn enough to collaborate with Scott on the communication between the microprocessor and these two devices. The team was able to get together and discuss a few different parts such as using different, smaller stepper motors and also the design of the claw was changed to allow minimal mechanical requirements.

### Hours Worked

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