Work Completed

While the project was continuing at a slow pace with construction of the arm, storage assembly, cutting device and the LABView programs underway several key components were not working as hoped. First the vacuum pick up tubing was connected to the vacuum source and attempts were made to pick up medication. Tablets could be picked up at 12.0 volts with pumps in series. However this was too little and ran the pumps too hot, therefore a shrink-wrap tip was made to help reduce the required voltage and increase the ability to pick up larger pills. It was mildly successful in doing so yet still required at least 8.0 volts and pumps in series. It was obvious that a better tip was required and therefore two additional materials were tried, a silicone wax and a tube gig fishing lure. The silicone is too tacky and picked up pills by adhesion alone. The tube gig was cut to expose a conical recess. The tubing was inserted into the tube gig and the head was shrink wrapped into place. This tip worked very well and could adequately pick up pills at the required 6.0 volts yet still in series operation. A mold made from a mechanical pencil and the lead refill tube that would provide a smaller tip with thinner walls and more gradually tapered cross section. This configuration worked very well utilizing a single pump at 6.0 volts. The tip was secured to the tubing with the use of shrink-wrap.

Secondly, the entire design required a very large footprint. Without changing the basic operating procedure largely the design is now fitted into a 12 inches tube, for the most part. To accomplish this design nearly everything would need reconstruction. To begin the storage assembly was built on a ten-inch lazy
susan. The assembly was constructed of black polycarbonate and clear acrylic. Only eight storage modules were made due to inadequate black polycarbonate. Each compartment was built to a 4 inch outside diameter PVC coupling. The center ring of the coupling was removed to allow for the inner arm tube. Each compartment is orientated so that the inner wall is the deepest and thinnest allowing for better pill pick up. A heavy-duty servo (HB465) was mounted to the lazy susan at the center point. This allows the servo to move the lazy susan about its axis. For the arm, the tower which houses the lazy susan servo and arm servos is constructed of 3 inch tapering acrylic tubing acquired from a straw dispenser. The tubing was cut to 9 cm and the arm servo and lazy susan servo were mounted inside. This tubing was set 2mm about the lazy susan surface to allow free movement. Two 12-inch circles were cut from a sheet of .223-inch acrylic plastic. These circles will make up the bottom plate and midline plates. These plates will be secured together and to the arm tubing. This allows the lazy susan servo to position the storage assembly to whatever position is required independent of the arm movement.

Lastly the cutter assembly was too large for this set up (too wide) so an alternative cutter was mostly constructed from plastics. The central cutter is a commercially available cutter. The general operation is a pivot plate was made to bridge to gap from the inlet funnel to the cutting section. This plate pivots to allow the pills out after cutting. The flat “piston” which not only lowers the pivot plate but also pushes the pill into place for cutting moves the pivot plate. This type of cutter is susceptible the tablet rotation so foam was placed in the cutter section. Foam was also used on the piston. The piston is forced into position with two rollers, one on top and one on the bottom of the piston. A metal gear high torque servo is used to provide the prime movement. A second servo is needed to move the cutter arm.
This new setup is approximately 7 cm longer however ¼ the width allowing for placement within the 12 inch border.

The only true departure from operation is in the manner of pill management after cutting. In this design all pills in a compartment are cut and temporarily store below the cutter. The emptied compartment is moved below the cutter and transferred to the empty container. The now filled container can be reposition for ¼ cuts or left with ½ cuts. This change greatly reduced arm to pill handling cycles.

I have also developed servo control VI in LABView 8.0. And still our computer remains locked without the use of LABView 8.0 or the DAQ.

**Future Work**

Efforts will continue in development of the LABView control programs. The center hole for the mid plate must be cut so that it can be attached to the arm tube. Wires must be run through the arm tube. The cut servo must be installed. A 360-degree servo must be ordered. Additional black polycarbonate sheets must be ordered. The temporary storage funnel and dispensing servo must be installed but requires the midline plate be installed first. The bottom plate and midline plates must be connected together. The vacuum pickup tubing must be installed.

**Project Review**

I feel that with the additional equipment build time delayed the progress, the overall result will be more functional and provide a better platform. This configuration also allows for better mechanical alignment. In total I am happy with the development of the mechanical parts. However to programming is behind in part due to the lack of a computer and for my part in changing the system operations.

**Hours Worked**

Kevin Villani ~24 hours