Project Identity

Adjustable Back Angle Controller
Week 1
January 30, 2007
Alaena DeStefano

Work Completed

This week our group took the chance to review and begin characterizing our ordered parts. The parts received included the 2 scissor jacks from Camping World, 10 compression springs from Lee Springs, and 4 mosfets from Digi-Key. We focused on the scissor jack this week because our priority was to understand the load that this device would raise and lower. We started by taking the scissor jack (pictured in Figure I below) to the machine shop and measured the torque. This was done by applying a 200lb force to the top of the jack and lifting the load with a torque wrench. It came out to about 70 in-lbs or 5.83 ft-lbs. This is an important value for motor selection because it’s the maximum amount of torque the motor will need to be able to output when operating at maximum load.

Figure 1: Scissor Jack at full extension

Other values that are crucial to motor selection are power, current, rotational speed, and input voltage. As of now it has been decided that the input voltage will be 12V DC. The allowable current is based on how much the circuit design can handle which is still to be determined exactly, but it must stay within
a safe range. The desired operating speed ranges from a 5 second to 30 second raise from zero to 70 degrees; therefore the rotational speed of the motor has been calculated to have at least 750 rpms to operate at the fastest speed. There are ways to compensate for motors regulated at lower rpms and that is to attach a gear system to the motor that will multiply the rpms. The power is really dependent on the rotational speed. The faster the rotational speed, the greater horsepower needed to operate the motor. If the motor is around 750 rpm, then the power needed is about 1/8 HP.

One experiment was run this past week in which we tested the properties of a gearmotor that we found in the senior design lab. The motor that fitted our specifications closest was the Dayton 1L471 (Pictured below in Figure 2), which is labeled for 12V, 6.5A, and capable of 6.25 ft-lb of torque. We connected it to a DC power supply in the senior design lab and discovered that, unloaded, it only drew about 2A.

One other aspect of the project that was worked on this past week was the framing for the device. A twin size metal bed frame (see Figure 3, next page) has been selected to be purchased Monday. Several ideas have been sketched out to accommodate for this purchase. It makes sense to have a sturdy metal frame for the movements the bed will incur. It is our hope that we can lay plywood ontop to simulate a bed and attach the adjustable bed back angle controller. The framing is raised 7.3” which is plenty of clearance for the jack and motor which is estimated to take up 5-6” of space.
Future Work

In the coming week we will perform more tests with the motor to determine the current-torque properties of the motor with an applied load. This can be done by reading the measurements of a torque wrench on a nut attached to the motor drive shaft as it rotates at different voltage levels. Once conclusive testing on the motor is performed an appropriate motor can be selected and purchased. It is my hope that the purchase order for the metal bed frame is completed by this next week so that the device can start to be built to the frame.

Project Review

At this point there are still some bugs to be worked out before the motor can be selected. The properties of DC motors, particularly the torque-current relationship, need to be better understood to ensure the proper starting torque to prevent stalls or overloads. The motor selection is crucial for proper operation and can potentially be very expensive. The bed frame selection has been made which will allow us to start building the device right on the frame. We are well within our $2,000 budget seeing as we have only spent about $205.

Hours Worked
12 hours