ECE Senior Design Weekly Report

Engineer’s Name: Mark Luna Date: 4/20/17

Team Name: The Globetrotters Lab Section: 4, Thursday 12:30 PM

Week’s Task: Fine-tune ADC clock to meet specifications, begin implementing control system algorithm in code and test levitating a magnet.

Results:

* Running the ADC strictly off the system clock, I measured the intervals at which conversions were finishing on the oscilloscope and noticed that the intervals were not consistent, most of the time taking longer than they should. The reference manuals revealed that the ADC could not run at its optimal speed of 1.1 Msps when running off of the system clock operating at 60 MIPS. Therefore, using the ADC’s clock divider, I reduced it to run at ~13 MHz initially and measurements of the conversion intervals showed consistent periods between conversions.
* Together with other team members, we implemented a very general PID control algorithm in the PIC24 microcontroller and connected all the associated inputs from the hall-effect sensors and outputs to the H-Bridges and the electromagnets. We changed some of the variables and mapped the values directly to the PWM output signals, while at the same time attempting to limit the duty cycle to stay under 50%. We are not sure if this is how the values from the calculations will be mapped in the end, but just for testing purposes, this allowed us to feel the force being placed on the magnet we held above the ring magnet and electromagnets. By also measuring the PWM signal on the oscilloscope, we observed that around the middle, the duty cycle was smaller, and at either of the edges, the duty cycle increased. Some of the problems we noticed so far are that the algorithm does not appear to be responding fast enough to change the amount of force and direction when required, which is probably due to how we’re accumulating previous results with the new results. The other problem is that we are seeing what looks to be some sort of overflow, as the measurements on the oscilloscope keep jumping from max duty cycle to smallest duty cycle and repeating when we either hold the solid magnet at the extremes or edges, or when there is no magnet present at all. What we would like to see initially is a consistent maximum duty cycle before we decide how we are going to handle the case when there is no magnet present to prevent overheating the electromagnets.
* Most recently, we ran into a problem were the microcontroller does not seem to reprogram with new code as we tried reverting back to a previous state, so we are actively trying to fix this so we can continue testing.