ECE Senior Design Weekly Report

Engineer’s Name: Mark Luna Date: 4/13/17

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

Week’s Task: Continue tuning microcontroller and associated peripherals for our design, test operation with our current h-bridges, and assist in the testing of other levitation components.

Results:

* As suggested during our previous team meetings due to us not being too concerned with power consumption, the PIC24’s system clock speed has been bumped up from 7.37 MHz to its max of 140 MHz and has been verified by outputting the clock directly to a pin for measurement as well as observation of the increased speed of all the other peripherals we are using that use the system clock as their clock source, including the output compare module used for PWM and the ADC module. The ADC is now sampling at a much higher rate so if it becomes an issue we can always associate its clock to a slower timer, otherwise this is good for us. Using the system clock as a source, the output compare module’s highest counter value set at around 3000 will produce the necessary and maximum 20 kHz PWM signal that the h-bridge can handle. Hence the resolution of the PWM signal will be between 11-bit and 12-bit, which is something for us to keep in mind when designing our control algorithm inside the microcontroller. Direct memory access functionality for accessing the ADC results was looked into but not implemented.
* To test that the direction switching and PWM signals from the microcontroller worked with the h-bridge at 3.3 volts, we measured the signals on the oscilloscope and connected them together along with a bidirectional motor, using trim pots as the analog input sources. We verified that the devices worked together, where the PWM signal would increase or decrease the motor speed and the direction would switch on the h-bridge so that the motor’s spinning direction would also switch from one to the other. The motor was only used to verify that the direction and current would switch as we would expect.
* I’ve been working with the rest of the team to test components such as the hall-effect sensors and amplifier circuit and how they react relative to the magnetic fields present, and the electromagnet coils, observing the heat properties as they are left with a constant current flow to determine if they current material they are wound around is good enough for testing purposes. Since currently the coils have cardboard on the top and bottom, we needed to know if we could test everything without risk of the cardboard burning. In this case, after running the coils with 2-3 amps of current for approximately 4 minutes, the coils reached 200 degrees Fahrenheit, where we had previously tested that the cardboard would start burning at over 300 degrees. Therefore, for testing purposes and since we do not plan on running the coils with a constant 3 amps all the time, this setup may be sufficient until we can get a better material for the final design.