**To:** Dr. Trevas

**From:** Aaron Curley

Due: 8/30/2020

Re: Self-Learning

The skill I decided to learn for the self-learning assignment was executing Simulink models on Arduino using the Simulink support package for Arduino hardware. Simulink is software used for control system design, modeling and simulation. I choose to learn Simulink to better understand and analyze Arduino circuits. This self-learning topic will also increase my knowledge of Arduino analog inputs and outputs. This skill will develop the design attributes modeling and testing.

To get started I first had to install MATLAB and Simulink support packages for Arduino to get access to the needed functions. This was easily done through MATLAB add on menu. After installing the support packages and connected the Arduino configuration parameters in Simulink needed to set. These parameters included hardware board, simulation time, and solver fixed-step size. With the parameters set I proceeded to build a very simple Simulink model. The model's purpose was to turn the on-board LED on and off. The model is shown below in figure 1.
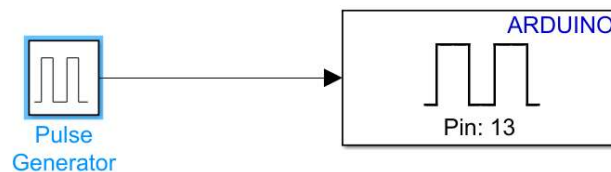

Figure 1 – Simulink model to blink LED connected pin 13

The model consists of a pulse generator and a digital output. The digital output is assigned to pin 13 because the onboard LED is connected to pin 13. The pulse generator supplies a square wave to pin 13 that turns the LED on and off. The square wave has an amplitude of 1, a period of 1 second, and a pulse width of .25 seconds. Once the model was built it the Arduino program was compiled and sent to the board over USB. The illuminated LED is show in figure 2
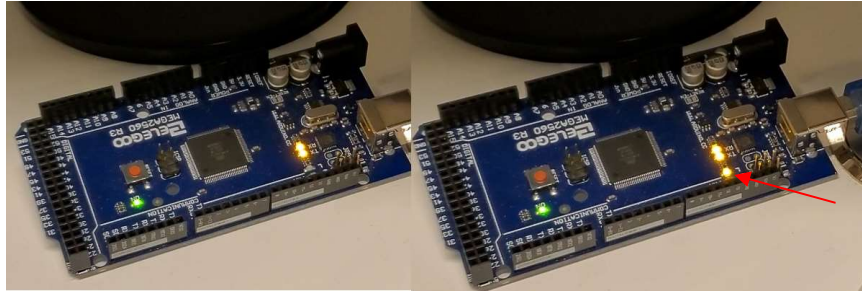
Figure 2 – Led

Now that I figured out how to run simple Simulink models on Arduino I started working on creating a Simulink model to read input from a hall effect flow meter. The flow meter will be used in my capstone team's project. The flow meter will provide a way for us to calculate flow rate in our aquaponics irrigation system.
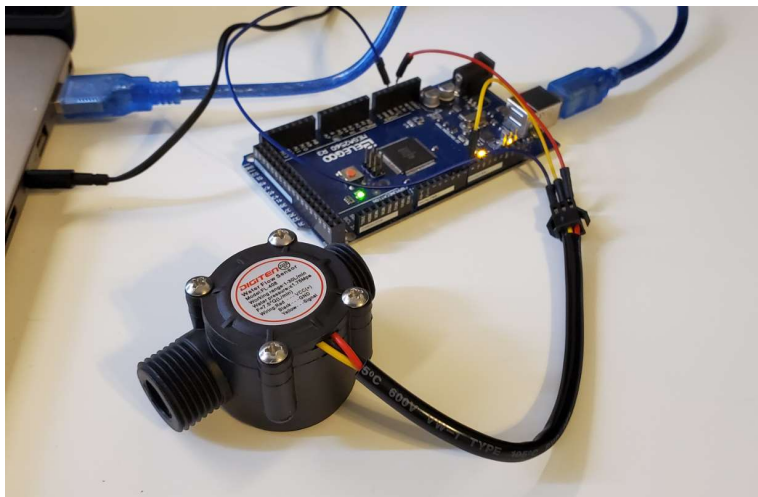
Figure 3 - Flow meter connected to Arduino mega2560 connected to computer
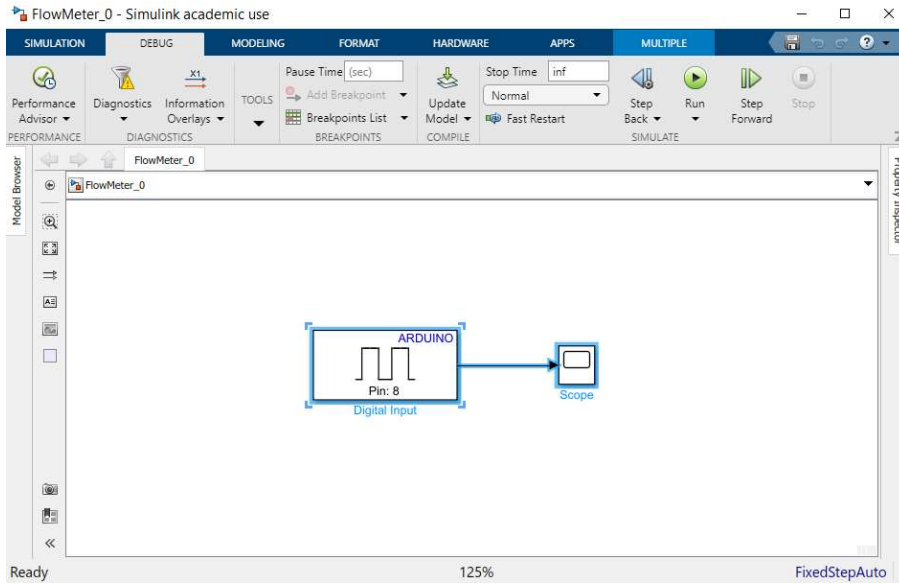
Figure 4 - Simulink flow meter model.

Figure 4 shows the setup. The meter is connected to ground, 5 volts, and pin #8. Figure 4 shows the Simulink model which is made up of a digital input block and a scope block. When the simulation starts the scope will read digital input on pin #8. Figure 5 below shows the digital input readings when I blow into the flow meter causing the turbine to spin. The data sheet says the frequency of the pulses is equal to 7.5*flow rate.
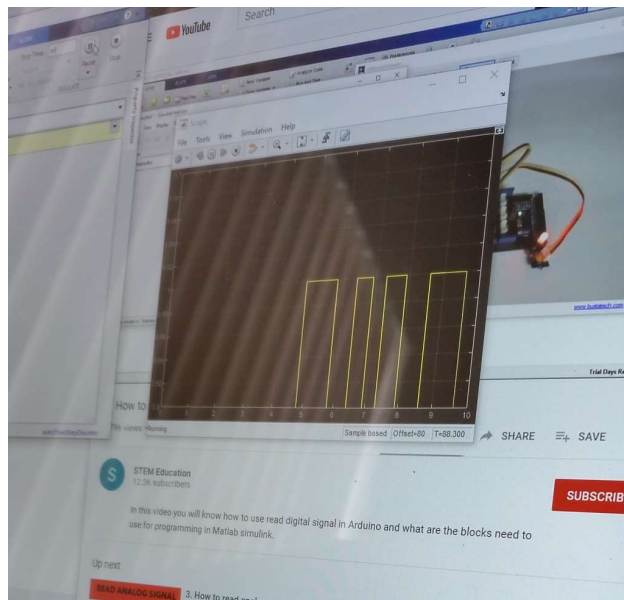

Figure 5 – Scope square wave reading

The next step in my self-learning journey will be learning how to use this data to control a buzzer or other noise making device that will sound when the flow rate in our aquaponics system drops too low.

Works cited

[1]R. Ahmed, "MATLAB/SIMULINK Bible|Go from zero to hero", *Udemy.com*, 2020. [Online]. Available: https://nau.udemy.com/course/matlabsimulink-biblego-from-zero-to-hero/learn/lecture/10041712?start=30#overview. [Accessed: 28- Aug- 2020].

[2]"How to read analog signal in Arduino using Matlab Simulink", *Youtube*, 2020. [Online]. Available: https://www.youtube.com/watch?v=8Bqsck46kBg. [Accessed: 28- Aug- 2020].

[3]*MATLAB*. Mathworks, 2020.

[4]"MATLAB Support Package for Arduino HardwareDocumentation", *Mathworks.com*, 2020. [Online]. Available: https://www.mathworks.com/help/supportpkg/arduinoio/index.html?s_tid=CRUX_lftnav. [Accessed: 28- Aug- 2020].

[5]"Simulink Support Package for Arduino Hardware", *Mathworks.com*, 2020. [Online]. Available: https://www.mathworks.com/matlabcentral/fileexchange/40312-simulink-support-package-for-arduino-hardware. [Accessed: 28- Aug- 2020].