UNIVERSITY OF LOUISIANA AT LAFAYETTE

MEASUREMENTS AND INSTRUMENTATION

MCHE 357

Lab 7

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Introduction

This lab consisted of learning to use an Arduino, a simple microcontroller used often by hobbyists and even some professionals to gather data or control small electronic systems. In this lab, the board was used to blink an LED at a fixed rate, at a rate determined by a potentiometer, and writing voltages out to pins.

Theory

Digital systems are by nature only capable of generating a fixed voltage, meaning that the voltage output is either on or off. However, systems often require that voltages between off and on are required. Digital systems can recreate analog systems in this way by use of a method called pulse-width-modulation (PWM). This method times extremely quick pulses of voltage such that the average voltage of the signal over time amounts to a desired voltage level.

An Arduino microcontroller can also read a signal, or voltage input. This allows the board to read a potentiometer, for example. This can allow a user to change system parameters with a potentiometer without changing the program on the mirocontroller.

Procedure & Analysis

The first program uploaded to the Arduino board was used to toggle an LED on or off every second. This was done by sending a voltage to the LED for one second, and then turning the voltage output off for one second. This program is simply repeated indefinitely. The physical setup for this program is shown in Figure 1.

The second program uploaded to the Arduino board was used to toggle an LED on or off with a frequency dependent on the reading from a potentiometer. This was done by reading the voltage that was coming back from the potentiometer. This value was then mapped to a time for the microcontroller to delay before toggling the LED. The physical setup used for this program is shown in Figure 2.

The third program uploaded to the Arduino board outputted a voltage to a pin which was then read with a multimeter. This program utilized PWM in order to write to a pin any desired voltage between off and on levels. The physical system used for this program, including the multimeter reading, is shown in Figure 3.

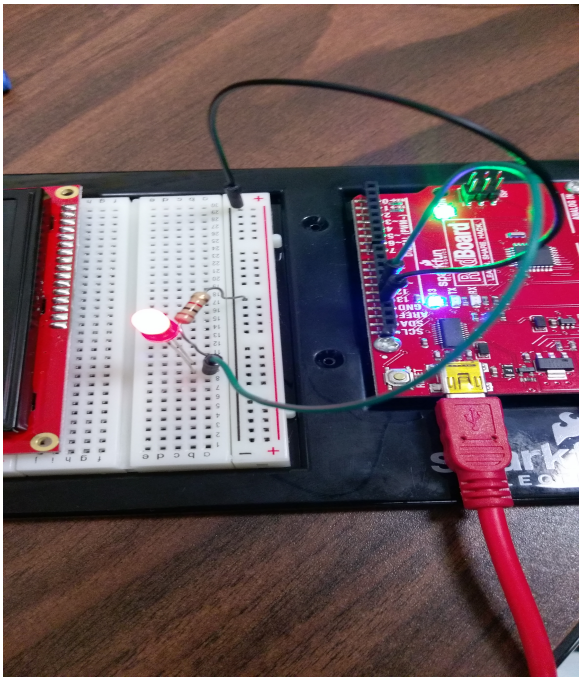

Figure 1: Blinking LED at Fixed Rate (On)

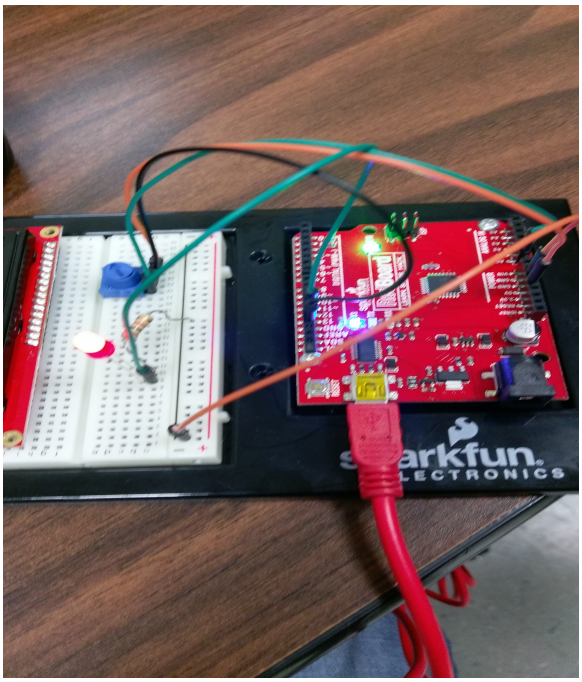

Figure 2: Blinking LED at Potentiometer Rate (On)

Figure 3: Signal Output Reading

Conclusion

The exercises conducted in this lab demonstrated using an Arduino microcontroller. It was shown that while simple, easy to use, and cost efficient, an Arduino board can be a powerful tool for use in engineering experimentation. It is well used to control systems as well as acquire data. It is useful for engineering students to gain experience with microcontrollers, as they are found all throughout industry.