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May 21, 2021
5193-6096

Report – Basic Microcontroller (Part 1)

Introduction

The purpose of this module is to introduce the PIC microcontroller that we will be using for the rest of the module. For this first part of the module, a very simple circuit is to be designed and implemented. The circuit shall consist of a switch which controls whether an LED flashes or a piezo transducer beeps. The LED shall flash at a 2Hz rate when selected, and the piezo shall beep with a 2Hz frequency while selected.

Design

This circuit consists of few connections and was implemented directly on a breadboard. The switch, LED, and transducer were connected directly to the I/O ports of the PIC microcontroller. Power was supplied to the board via an Arduino. The schematic below shows the layout of the circuit.

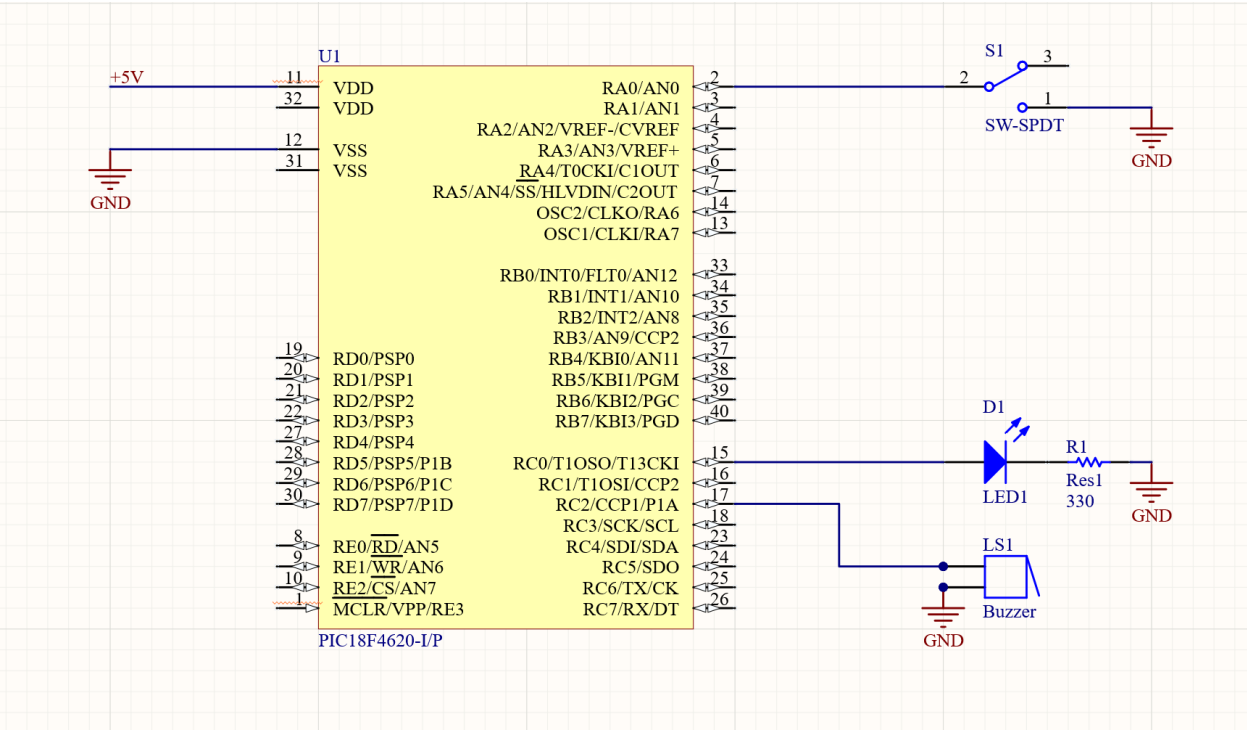

Figure 1. Altium schematic

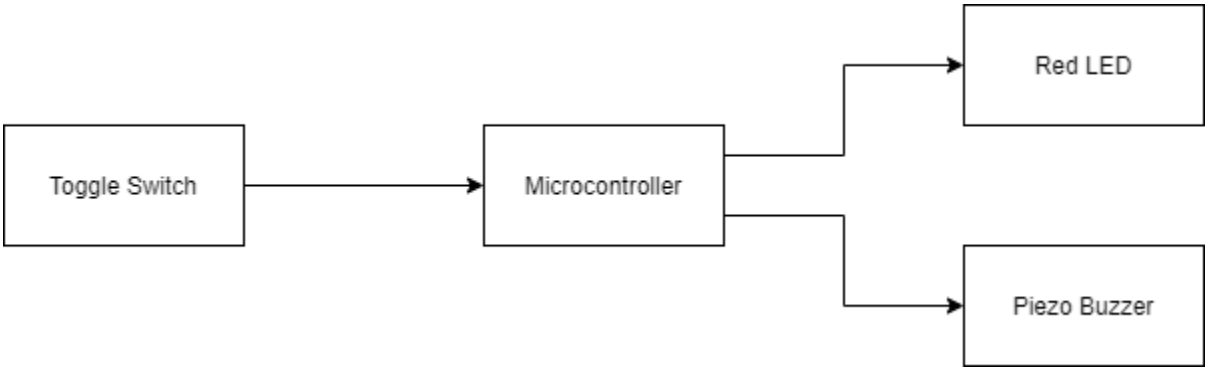

Figure 2. Hardware block diagram

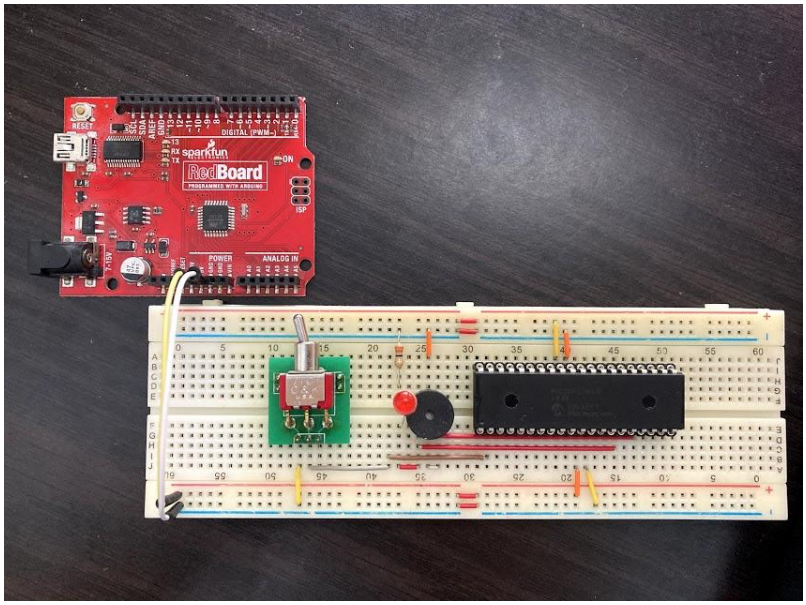

Figure 3. Physical circuit implementation

The software controlling the circuit is also quite simple. It consists of an IO initialization function followed by a continuous loop which checks the state of the switch to determine the mode of operation. Once inside of a specific mode of operation, a function runs to turn on and off the appropriate output at the required rate using software delays. The PIC was programmed using the SNAP programmer included with the lab kit. The code utilized is shown below.

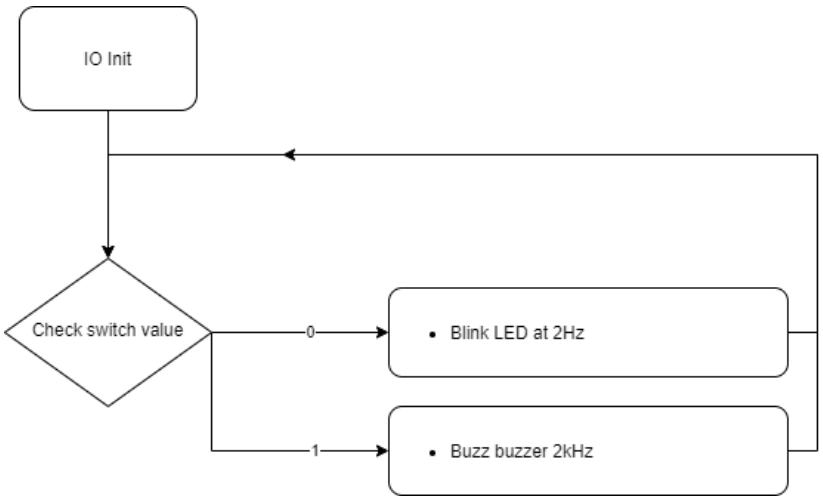

Figure 4. Software flowchart

The waveforms produced by each mode are shown below.

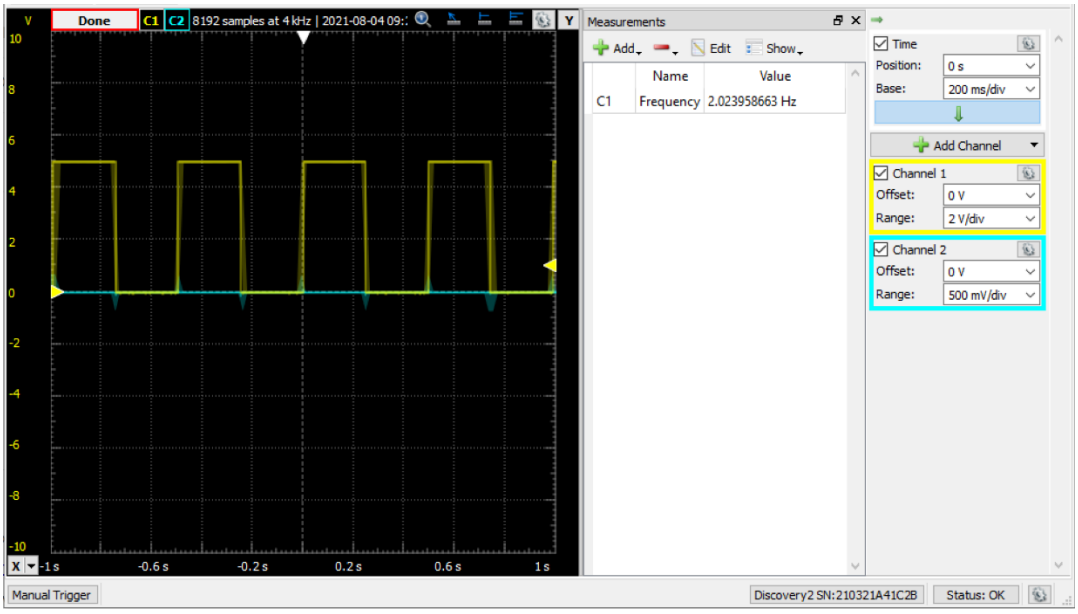

Figure 5. LED cycle at approximately 2 Hz

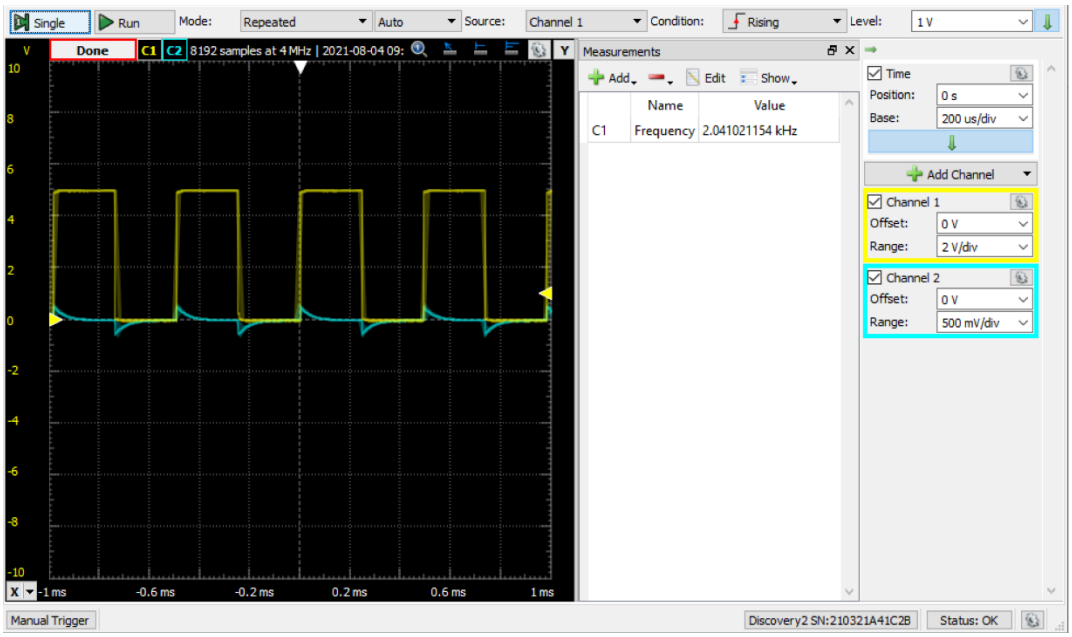

Figure 6. Piezo buzzer cycle at approximately 2 kHz

Design 1 - Final Project - Bill of Materials				
Description	Quantity	Price/Part	Part Number	Source
Microcontroller	1	$ 2.88	PIC18F47K40-I/P	https://www.digikey.com/en/products/detail/microchip-technology/PIC18F47K40-I-P/6208289
Red LED	1	$ 0.18	L513SRD-C	https://www.digikey.com/en/products/detail/american-opto-plus-led/L513SRD-C/13556881
Piezo Buzzer	1	$ 0.96	TFM-25E	https://www.digikey.com/en/products/detail/east-electronics/TFM-25E/12618158
Toggle Switch	1	$ 4.50	A13JP	https://www.digikey.com/en/products/detail/nkk-switches/A13JP/1053319
	Total:	$ 8.52		

Conclusion

The design and implementation of this module was overall a success. Neither the hardware nor software called for anything beyond basic techniques. While software delays are less than ideal in terms of efficiency, this implementation was rather trivial and as such, using software delays had no adverse effects on the circuit's functionality. This lab served as a helpful introduction to using the microcontroller that we will use for the following more advanced project.