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EC4350 HW6
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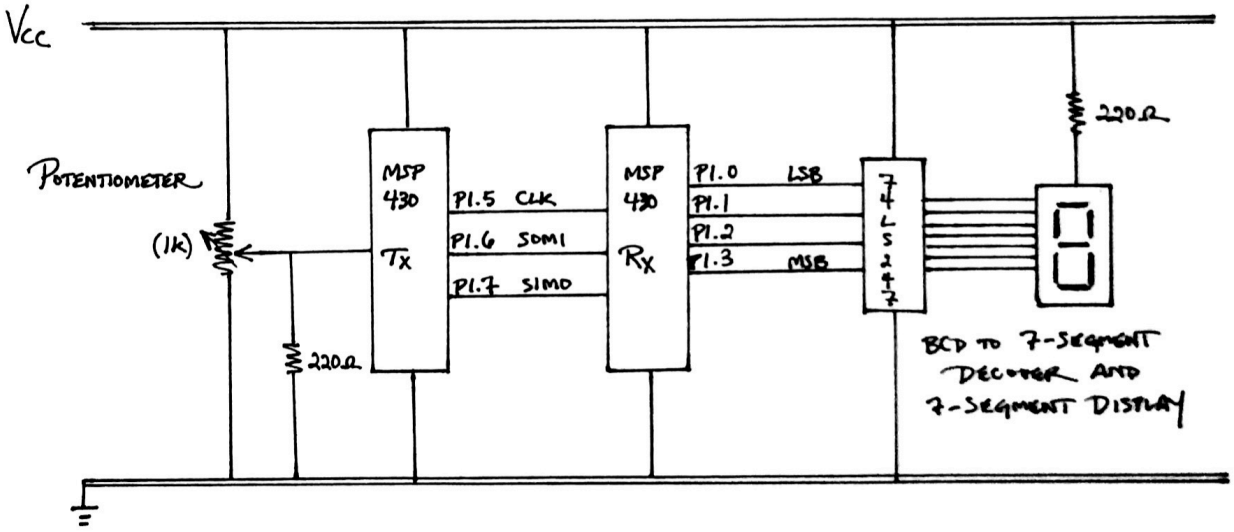
EC450 Homework 6

Circuit Design:

We chose to implement our circuit as follows:



Analog Input
Our analog input to the Transmitter (Tx) is the voltage across a potentiometer in a voltage-divider circuit. As the resistance is varied this changes the analog voltage read by the ADC on P1.4, varying from 0V to Vcc (3.3V). The ADC converts this voltage to a value between 0 and 1023.

SPI Interface
We chose to interface our Tx and Rx controllers using SPI. The two controllers share the SPI CLK, SIMO, and SOMI lines and a common ground. We send only one byte across the SPI interface per ADC conversion.

Digital Output
Our digital output is a 7-segment display that displays a decimal number between 0 and 8 depending on the voltage read by the ADC. We used a 74LS247 BCD to 7-Segment Decoder to translate 4 address lines from the Receiver (Rx) into the correct lights on the 7-segment display.

Virtues and Limitations:

Since we only send one byte per conversion, the SPI interface is fast enough to keep up with the ADC converter. Of course, sending only one byte means leaving the 2 most significant bits behind for each transmission. Since we cast the 10-bit result from the ADC into 8-bits, our digital value “wraps around” several times as the ADC conversion goes from 0 to 1023. This means we can only accurately measure low voltages where the ADC conversion is below 256.

The potentiometer we use to create a variable voltage is not particularly accurate or easy to use. Ideally we would have used a photo resistor but none were readily available. A photo resistor can easily be inserted in place of the potentiometer to make this system a more interesting and practical light meter.

Although the 7-Segment Decoder is designed to operate at 5V it seems to work fine at the 3.3V of the MSP430. Operating outside of the chip’s limits may cause long-term damage but is no issue for the purposes of this homework.