Embedded System Laboratory Course

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Protected: Lab 6 – Analog to Digital Converter (ADC)

Introduction:

In this lab, we are going to use a potentiometer to provide various analog input voltages. The analog input is connected to pin ADC0 as shown in the diagram below. By changing the input voltage, you should be able to convert the input voltage to a 10-bit digital value through successive approximation. The minimum value represents GND and the maximum value represents the voltage on the AREF pin minus 1 LSB. Write this digital value to PORTD and consequently light different LEDs connected to PORTD.
Read the datasheet Chapter Analog-to-Digital Converter. The related registers are **ADC**, **ADCSRA,** and **ADMUX.** I summarized several hints as follows:

- Set ADEN in ADCSRA to enable Analog to Digital Converter.
- Set the bit ADSC to start every single AD convert. This bit will be cleared after each conversion.
- ADC registers, ADCL and ADCH, contain the 10-bits conversion result:
    ADC = 1024*V(in)/V(aref)
- Once ADCL is read, ADC access to the Data Register is blocked. Only after ADCH is read, ADC access to the ADCH and ADCL Registers is re-enabled.
- On completing a single AD conversion, an ADC interrupt will be triggered if the corresponding enables bit is set.
- By default, the successive approximation circuitry requires an input clock frequency between 50kHz and 200kHz to get maximum resolution. Set a proper prescaling by the ADPS bits in ADCSRA.
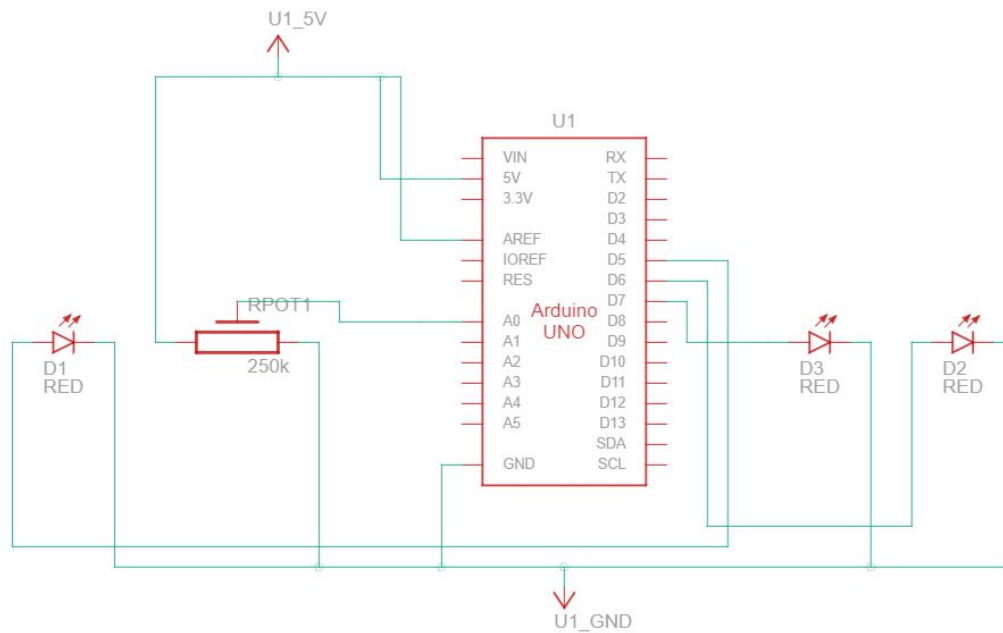
PreLab Tasks:

1. Read the ATmega328 datasheet (Chapter 24: Analog to Digital Converter)

2. Design your program to convert an analog voltage input to a 10 bits value by ADC interrupt.

Lab Assignments:

1. Using a Potentiometer to control the input voltage.

2. Write codes to convert an input voltage into 10 bits value. Output any 8 bits out of these 10 bits to PORTD.

3. Connect 3 pins of PORTD to 3 LEDs and observe the AD converting results.

Lab Report: The requirements are the same as the previous lab.