ET 095G Programming Exercise 2: Analog Inputs and Outputs

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1 Background and Learning Goals

Microcontrollers, as any computer, are digital devices (i.e., they operate with discrete signal levels and at discrete time steps). However, embedded systems often need to interact with their surrounding, which frequently requires signal conversion between analog and digital. In this exercise you will learn how to control analog inputs and outputs in the mbed system. After this exercise, you should be able to:

- produce analog outputs with the help of the AnalogOut API.
- produce pseudo analog outputs by performing pulse width modulation (PWM).
- read analog signals and interpret their digital representation.

2 Preparation

All required information for this exercise can be found in chapter 4 and 5 of the course book. You can find further information on mbed and its API functions at https://docs. mbed.com.

3 Evaluation and Presentation

For evaluation, submit a functioning .bin file and the main.cpp file of your program for each of the subtasks. The main file should be well commented. For submission, use the respective inbox for this exercise on the moodle course page.

4 Tasks

4.1 Sub-task 1: AnalogOut

Produce a sine wave on p18. The sine wave should have a frequency of approximately 10 Hz and a peak-to-peak voltage of 2 V. Note: Verify your result with the help of an oscilloscope.

4.2 Sub-task 2: PWM

Using the RGB LED on the application board, generate a blinking white light with the help of pulse width modulation. The light, however, should not only switch on and off, but it should fade in and out with a total period of 4 seconds (i.e., its intensity continuously increases for 2 seconds and then decreases for 2 seconds). Note: Even here it can be quite useful to check the signal with an oscilloscope.

4.3 Sub-task 3: AnalogIn

Display the voltage of one of the potentiometers on a terminal emulator approximately once per second. The displayed value should be an average of 20 readings. Note: The default baud rate of the serial interface is 9600.