

Lab 7: Teensy A2D & PWM

CSE 2100-001

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1 Objective

Program the Teensy 3.2 microcontroller with the packetized serial communication program on the class GitHub repository (`serial_communication_variable.ino`). Use the original, unmodified code (not the modified 16 bit version from the previous lab) as the basis for this experiment.

Connect the multicolor RGB LED and potentiometer as shown in the demo video, and modify your program to perform the following operations...

1. If a properly formatted packet with a 4 byte payload is received, AND the first byte of the payload is 'L' (0x4C in ASCII code), then assign `payload[1]`, `payload[2]`, and `payload[3]` to the Red, Green, and Blue channels of the LED respectively. For example, the following packet should shine the LED in full red, with no Green or Blue light present.

0xAA 0x07 0x4C 0xFF 0x00 0x00 1E

Do not send a response packet in this case.

1. If a properly formatted packet with a single byte payload is received, AND the byte is 'P' (0x50 in ASCII code), then read the potentiometer value and scale to a single byte (`analogRead` in Arduino will return the value in the range [0-1024], so just divide it by 4). Once you have read and scaled the value, send a properly formatted response packet in the following form...

0xAA 0x05 0x50 [pot value] [checksum]

Demonstrate your program with CuteCom using the test cases provided by the lab instructors.

1.1 Definitions

A2D : analog to digital signal

DAC : analog to digital converter (DAC) is a device, for converting binary or digital code (comprised of a series of 0s and 1s) into an analog signal.

PWM : Pulse Width Modulation (PWM) is a method for generating an analog signal using a digital source. A PWM signal consists of two main components that define its behavior: a duty cycle and a frequency

frequency : frequency is the number of waves that pass a fixed point in a given amount of time.

duty cycle : duty cycle, expressed in percentage, specifically describes the percentage of time a digital signal is on over an interval or period of time

2 Question 1

What would be the integer result returned by a call to analogRead if 2.0 volts was present on the A2D pin?

Integer value = (applied voltage/5.0 v)* 1023 = (2.0/5.0) * 1023 = 409

3 Question 2

If the period of a PWM signal is 10ms, how much of that time would the signal spend in the low state at a 25% duty cycle (answer in ms)?

Since the duty cycle is 0.25 of the duty cycle, the off time will be 0.75 of the duty cycle,

The time spent by signal in low state will be $0.75 * 10 \text{ ms} = 7.5 \text{ ms}$.