

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, an electronic process in which a continuously variable analog signal is changed, without altering its essential content, into a multi-level digital signal.

DAC Digital Analog Conversion is a system that converts a digital signal into an analog signal, such as voltage, current, electric charge. Digital signals that have a few (usually two) defined states are turned into analog signals, which have a theoretically infinite number of states.

PWM Pulse with modulation is used for controlling the amplitude of digital signals to control devices and applications requiring power or electricity. It controls the amount of power in perspective of voltage component.

frequency is the number of complete cycles per second. The unit is in Hertz.

duty cycle is the fraction of one period in which a signal is active or it is the proportion of time during which a component, device, or system is operated. Duty cycle can be expressed as a ratio or as percentage.

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 result returned by a call to analogRead if 2.0 volts present on A2D pin was $2 \cdot 1024 / 3.3 = 620$

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)?

The signal spends 7.5 ms.