

EECS 388 Lab #5

Servo Motor Control

In this lab, we will control a small servo motor using PWM. In the case of an RC car, a servo motor is typically used to control the steering of the car.

Part 0: Setup the project

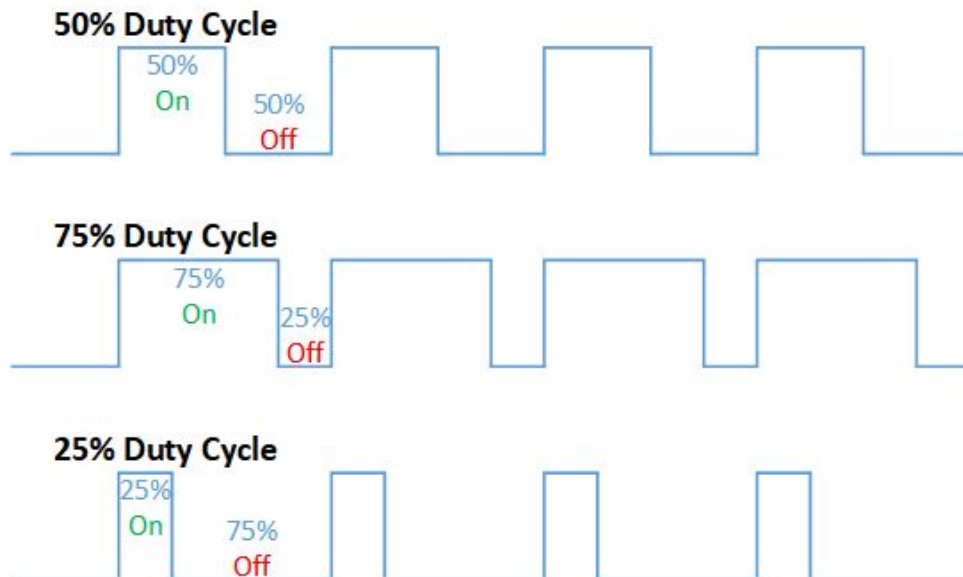
Download the project skeleton as follows.

```
$ cd ~/Documents/PlatformIO
$ wget https://ittc.ku.edu/~heechul/courses/eecs388/15-pwm.tar.gz
$ tar zxvf 15-pwm.tar.gz
```

Add the 15-pwm folder into VSCode workspace.

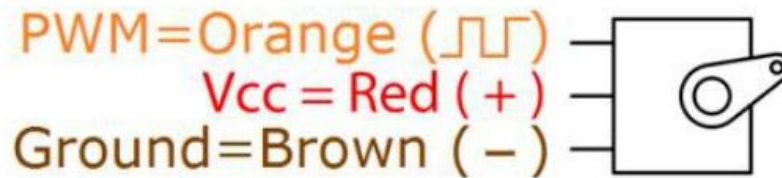
Part 1: PWM and servo motor

Pulse-width modulation (PWM) is a way to encode analog signals using digital outputs. Although a digital output can be either on or off at a time, by altering the durations of on and off, we can encode an arbitrary analog signal. For example, if a digital output is on for 25% of the duration (duty cycle) at 5V, its voltage is rated as 1.25V on average.

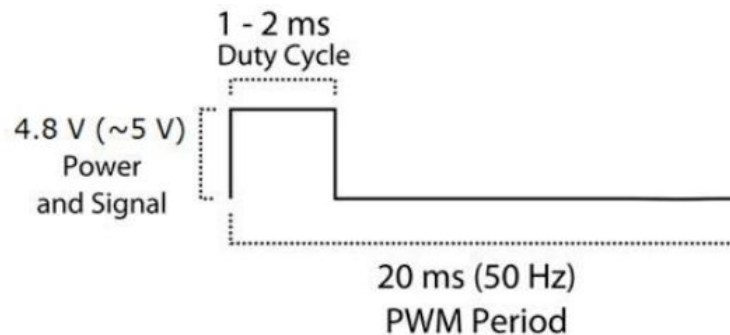


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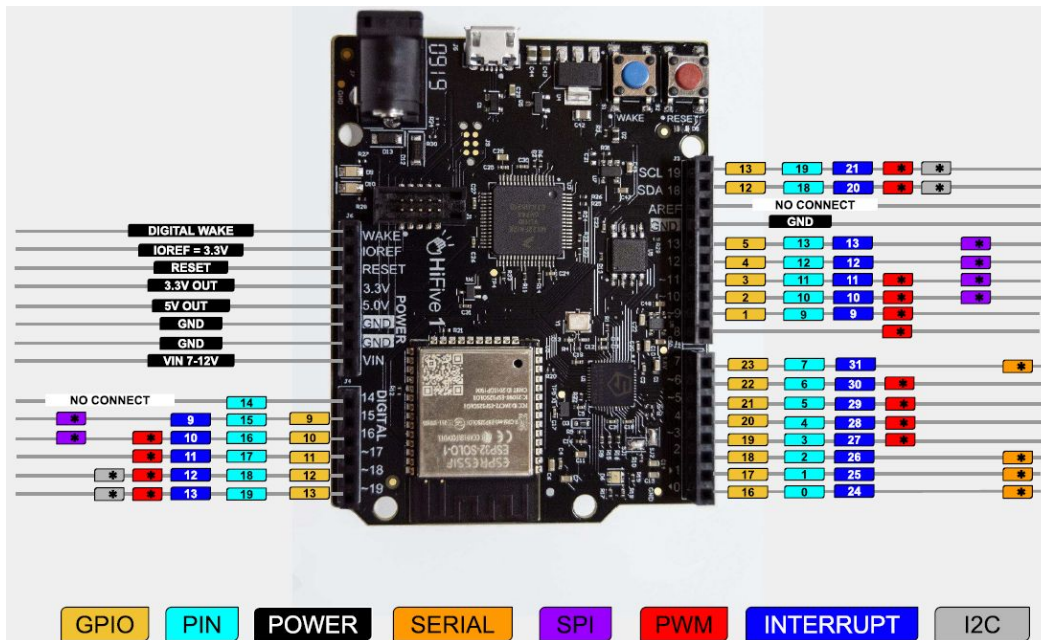
PWM has a wide variety of applications, one of which is servo motor control. In this lab, we use PWM to control a small servo motor (see docs/sg90_microservo_datasheet.pdf).



A servo motor receives a PWM signal whose value represents the desired angle of the servo motor. The PWM value ranges may vary depending on the specific servo, but most RC servo motors, including the one we use in this lab, operate between **544 us** (0 degrees) to **2400 us** (180 degree) duty cycle at a 20 ms period (50 Hz).



Connect the servo motor's Vcc (red, center), ground (brown), and PWM (orange) to the HiFive1 board's 5V, GND, and PIN 19 (gpio 13) lines, respectively.



Part 2: Servo control programming

For this lab, you will need to use two provided library functions: `gpio_write` and `delay_usec`. (See the code in `src/eecs388_lib.c`). Using these functions, you should output the ON signal (5V) for a specific duty cycle duration, followed by the OFF signal until the PWM period elapsed.

The project code you downloaded already includes the basic skeleton of the program, which will sweep different angles, each of which for about a 1 second duration.

You will need to fill the `servo` function in the `src/eecs388_pwm.c` to complete the lab.

Once you are finished, show your work to the TA.