Guide for Sinusoidal Driving for Servos

Introduction

The main purpose of this report is to demonstrate how one can drive servo motors and to explain what we used for which reasons.

There are various methods for multiple Arduino control to drive motors that one should start by choosing one. After investigating possible communication protocols, we decided to use the I2C communication method. Arduino have already I2C communication with own pins, so we just use a module to control servo motors, namely PCA9685.
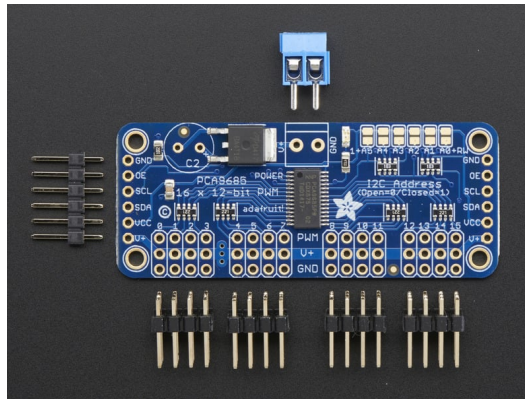

Figure 1: PCA9685 Module

There is some information about connections of pins at bottom of module like in figure 2. You can make connections between Arduino and module. For power supply, there are two options: If you use not many servos, you can use V+ pin next to other pins. However, you are trying to control many servos, you can use connectors in middle. Both of them worked without having problems.

Figure 2: Bottom of PCA9685 Module

Our motor's model is SW0231MGP. Which has these technical informations:

Operating Temperature: 14° - 122°F (-10° - 50°C)

Running Current (no load): 100mA @4.8V, 120mA @6.0V

Stall Current (at locked): 3800mA @4.8V, 4800mA @6.0V

Idle Current: 5mA @4.8V, 5mA @6.0V

Wire Length: 200 ± 5mm

Output Gear Spline: 25 Tooth

Operating Travel: 100° (1000 → 2000 μ second)

Neutral Position: 1500 μ second

Pulse Width Range: 800 → 2200 μ second

Maximum Travel: Appx 130° (900 → 2100 μ second)

Refresh Rate: 240 Hz

Considering these background and the module's limitations, we build the connections between, and continued with the coding process, which will be further investigated in the upcoming parts.

Connections

Before the beginning to connect pins to Arduino, to see Arduino pinouts is crucial. As you see in figure 3, there are some specific pins on Arduino which we will connect to specific module pins.

Figure 3: Arduino pinouts
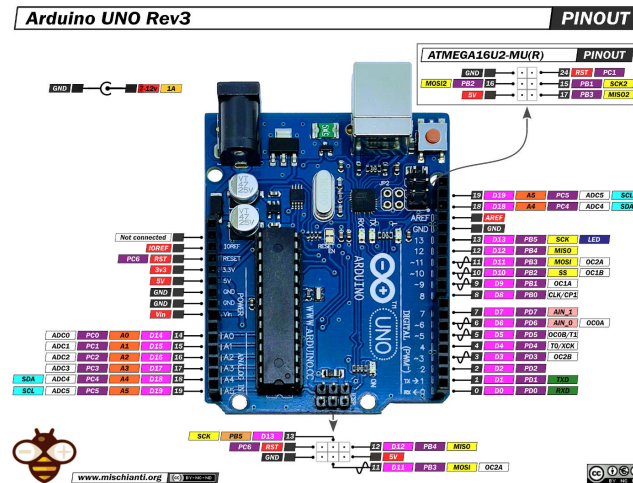
We arranged the cable connections as you can see in the table at the bottom.

Table 1: Connections

on PCA9685	on Arduino
GND	any GND pinout
OE	nope
SCL	19
SDA	18
VCC	5V
V+	nope

In addition to that, there are some points which you should be careful about:

• Generally, the module, connecting V_+ with 6V should drive the servo motors, but practical work doesn't comply with theoretical results, which we think may be caused by the currents being divided into multiple nodes. This case leads to an occurring problem of the blockage of the motors from driving properly. To study the case by testing, we began with 5 Volts and 2 Amperes, then slightly increased them with the increasing motor number. The final result obtained is that to drive 12 motors, it is proper to use 9 Volts and 7 Amperes. If you are trying different model motors, don't immediately start by supplying 9 Volts and 7 Amperes, start with lower voltages, until the desired values for your own case.

• In the last test, we did decide to use 6V and 7A limit. Because we had some motor issues that some of them shifted every period. In the future, we can change. • In the beginning, I give voltage from voltage sources via V_+ pin. After I try to drive 12 motors, jumpers can't carry the current, so I changed the pin of power and I give the power from connectors in middle.

Coding

I can say just that I examine sample codes in the library and create a function to make it easier for all my code to work. I mentioned comments on my GitHub page, you can go there and look. My all coding work, click to access

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