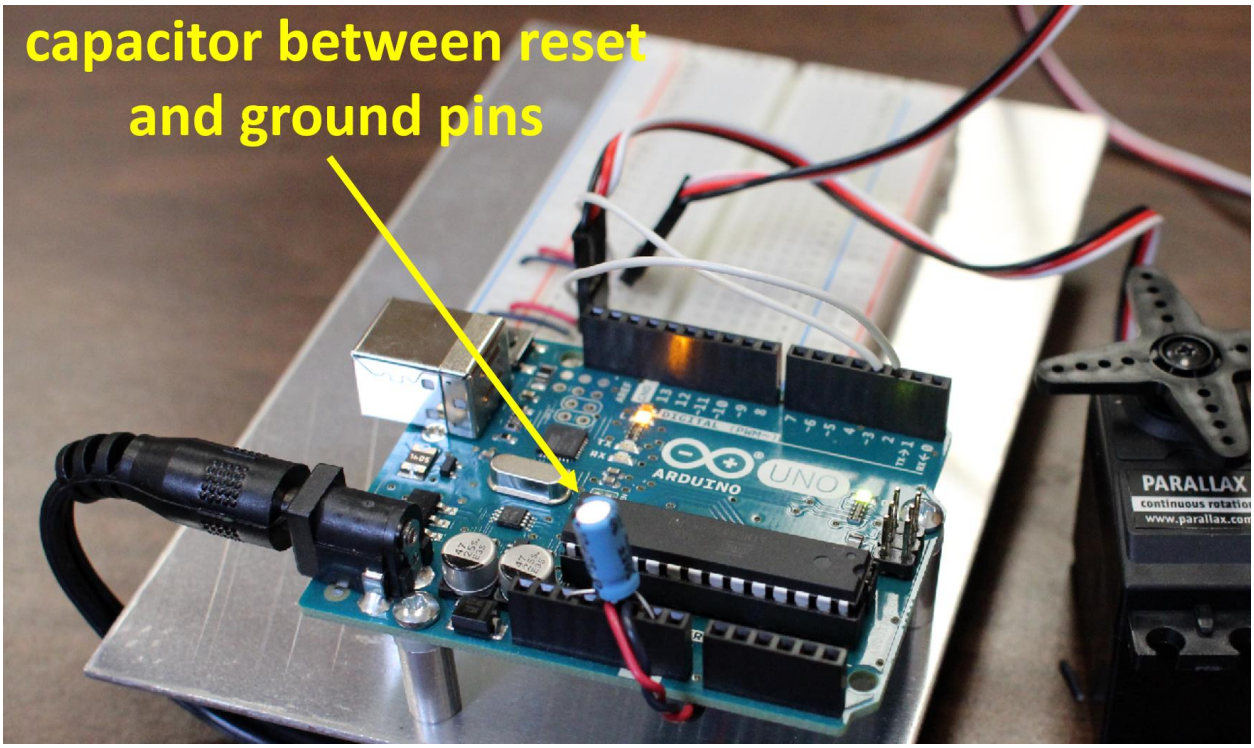
Fixing the Resetting Robot Problem

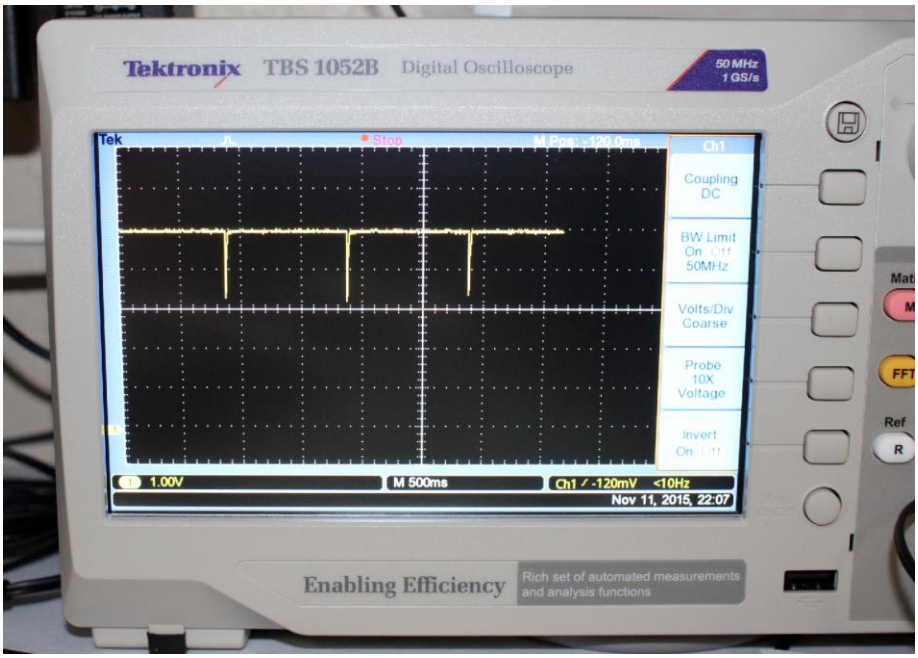
Some robots are more prone than others to “reset themselves” when starting or changing direction. It takes a burst of energy from the battery pack to provide the energy needed for the robot to change direction, and when this happens the voltage from the battery pack or voltage regulator may drop to a level that causes the Arduino to reset. This is frustrating because the robot works sometimes but doesn’t work other times.

A capacitor is a circuit element that stores electricity. A capacitor is somewhat like a battery in that it can provide power to a circuit when needed. Adding a small capacitor between the reset pin (which is positively charged at 5VDC) and ground will allow electrical energy to be stored in the capacitor. When the servos suddenly change direction, the small amount of electrical energy stored in the capacitor can supply enough charge to the reset pin to keep it from dropping to a level that will force the Arduino to reset. A photo of a 10µF (10 microfarad) capacitor inserted between the reset and ground pins on an Arduino Uno is shown below. Please be sure to turn the negative terminal of the capacitor toward the ground pin since capacitors have the potential to explode when connected backward.

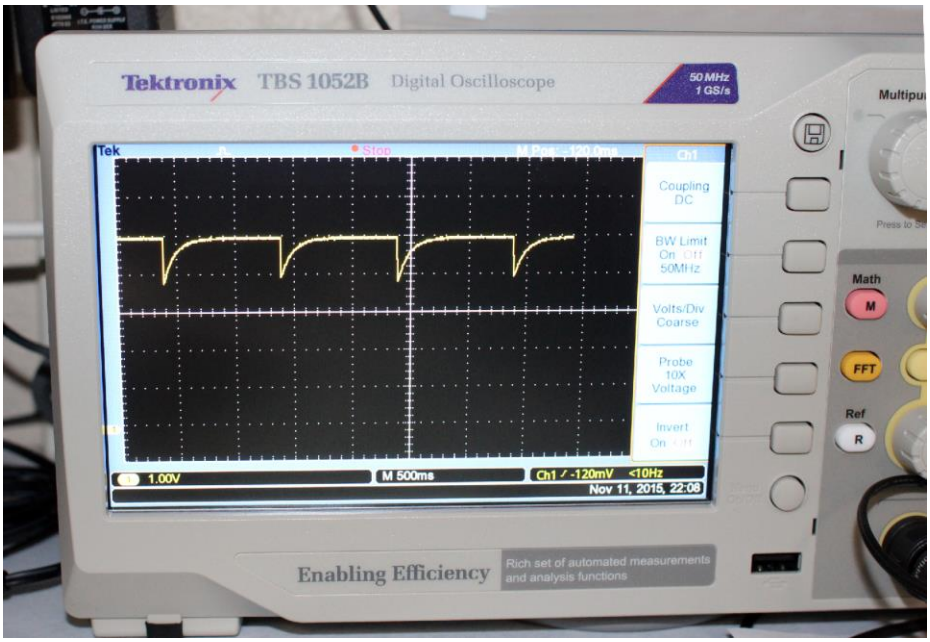


To illustrate the difference that a capacitor makes in the voltage at the reset pin, we can use a device called an oscilloscope to plot voltage versus time. See the photo below that shows the voltage at the reset pin when no capacitor is installed. Notice that the voltage drops from 5V to almost 3V (a 2V drop) when no capacitor is present. For the settings on the oscilloscope shown, the divisions on the y-axis (voltage) are 1V apart, and the divisions on the x-axis (time) are 500ms apart.

The voltage drop at the reset pin is approximately 2V when no capacitor is used:

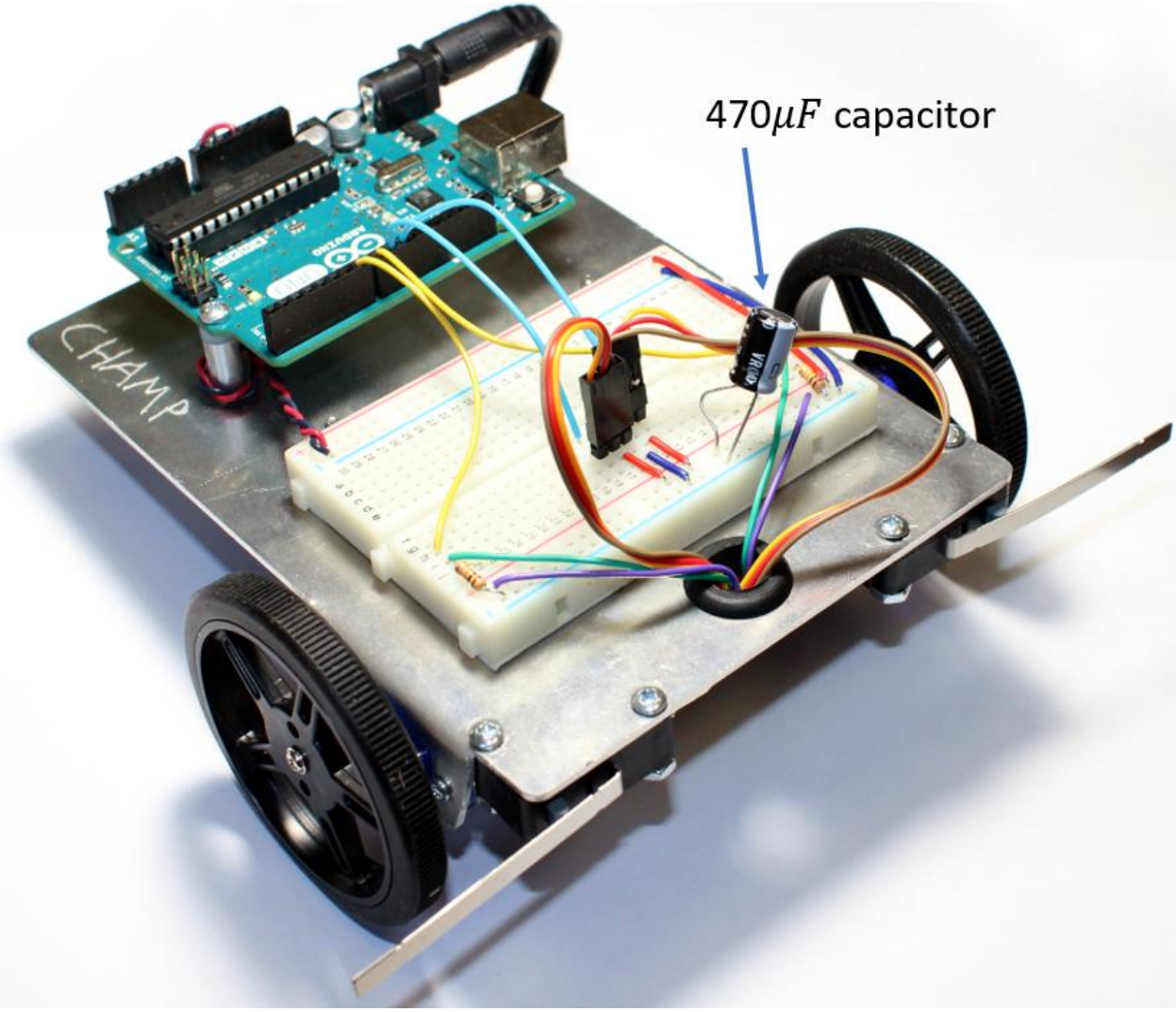


The voltage drop at the reset pin is about 1V when a 10µF capacitor is used:



When a capacitor is used, notice how the voltage builds slowly back up to 5V when the servos change direction. This is because the capacitor is recharging during this time. If a larger capacitor such as a 1000µF were to be used, the voltage drop would be smaller when the servos changed direction; however, adding a capacitor this large would delay the start of a program since it would take a while for the capacitor to charge up before the program could start running for the first time.

A writeup from adafruit.com entitled “If the Servo Misbehaves” recommends **inserting a 470µF capacitor between GND (ground) and 5V on your breadboard**, making sure that the longer lead of the capacitor is connected to 5V. You could put the capacitor between GND and 5V on the bus strip for convenience.



This larger capacitor would work like the 10µF capacitor described above, but with much more capacity to smooth out sudden fluctuations in voltage. Also, putting the capacitor nearer the source of the sudden energy demands (associated with a servo starting up or changing direction) would help shield the Arduino from the voltage fluctuations altogether. See the link below for the writeup from adafruit.

https://learn.adafruit.com/adafruit-arduino-lesson-14-servo-motors/if-the-servo-misbehaves