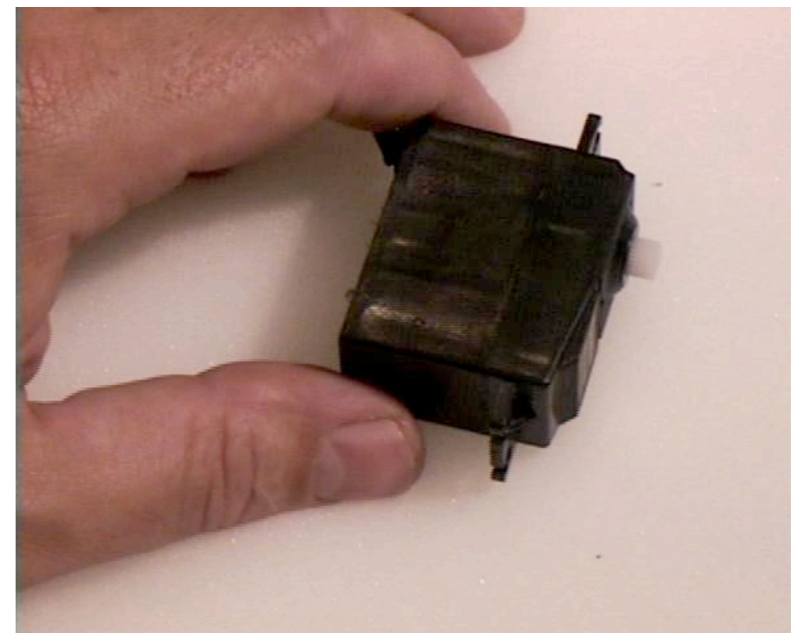
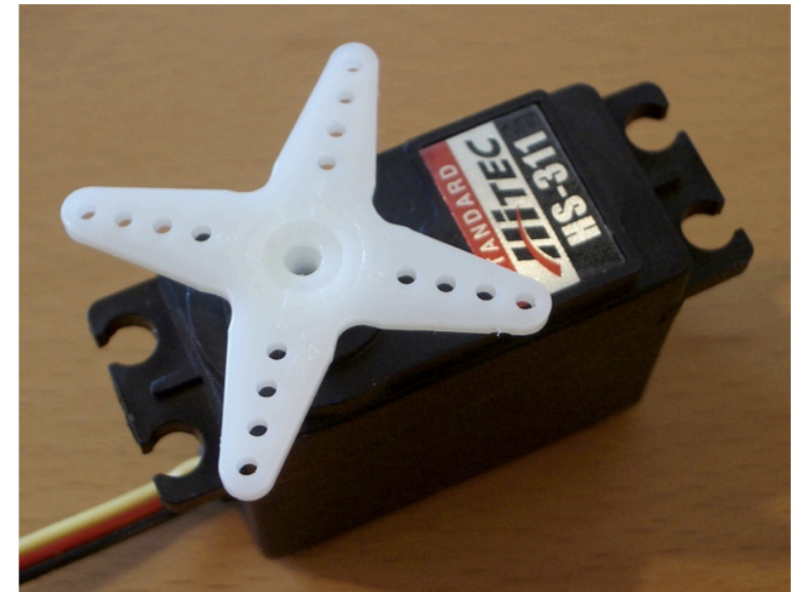


Moving things

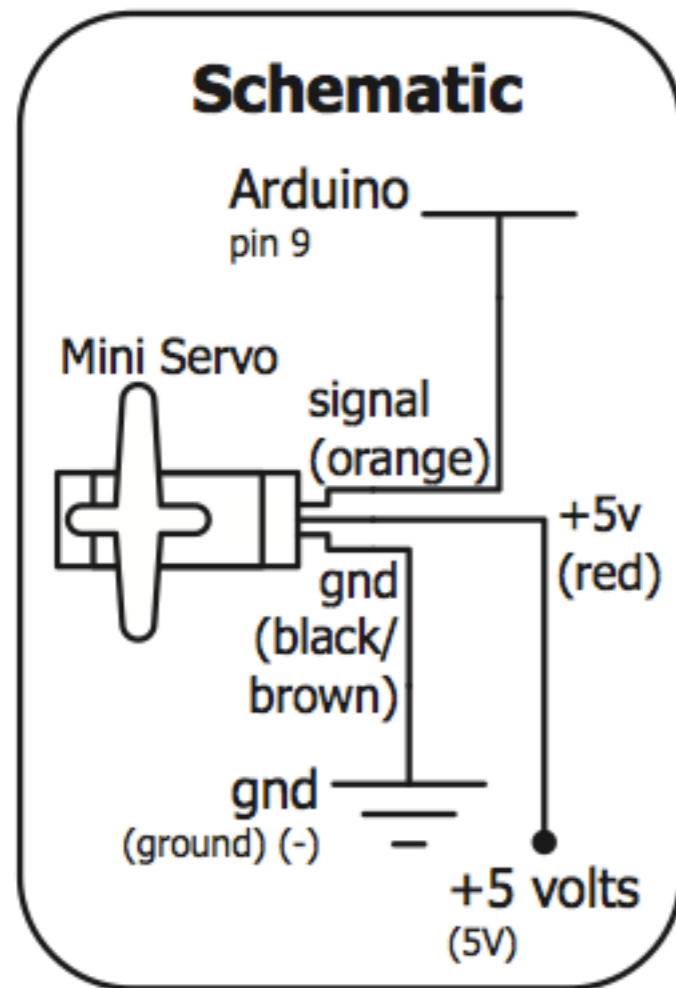
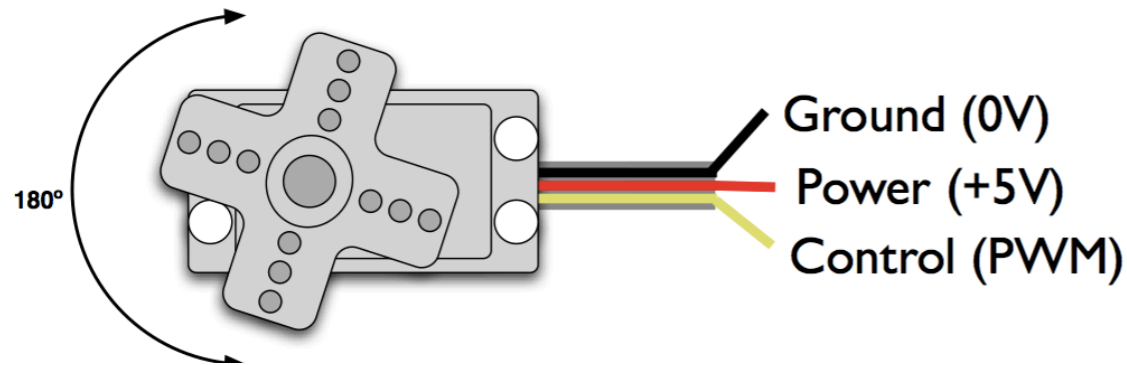
Day #4

Servo motors

- A Servo is a small device that has an output shaft.
- This shaft can be positioned to specific angular positions (0-180 degrees) by sending the servo a coded signal.
- As the coded signal changes, the angular position of the shaft changes.



Moving a servo



```
#include <Servo.h>
Servo myservo; int pos = 0;

void setup() { myservo.attach(9); }

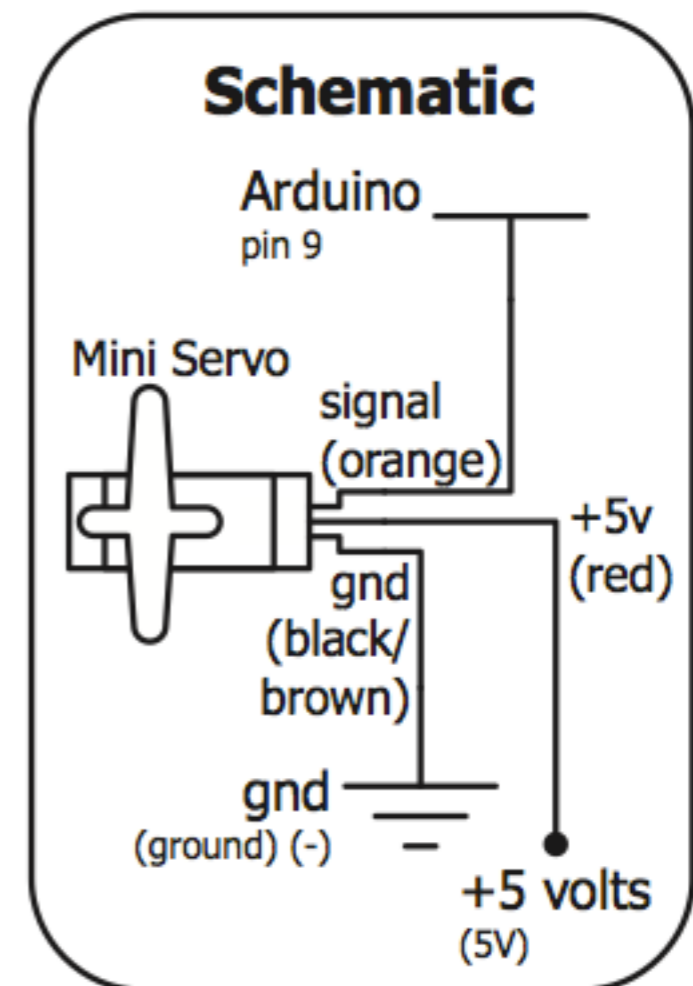
void loop()
{
    //move servo to 45 degrees
    myservo.write(45);
    delay(1000); //wait 1 second

    //move servo to 90 degrees
    myservo.write(90);
    //wait 1 second
    delay(1000);
}
```



Sweeping motion

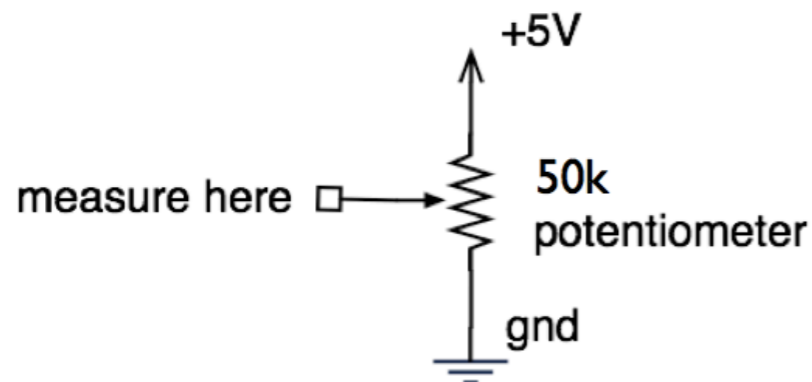
- Create a program that will continuously move the servo from 0 to 180 degrees and back.





Using a potentiometer to specify the servo angle

- Instead of sweeping all angles, use a potentiometer to define an angle.
- You need to determine what are the potentiometer analog input ranges.



```
//connect potentiometer to analog pin #0
//connect servo control to digital pin#9
#include <Servo.h>
Servo myservo;

int potpin = 0;
int val;

void setup() { myservo.attach(9); }

void loop()
{
    val = analogRead(potpin);
    // scale analog input to an angle
    val = map(val, 0, 1023, 0, 179);
    myservo.write(val);
    delay(15);
}
```

DC Motors



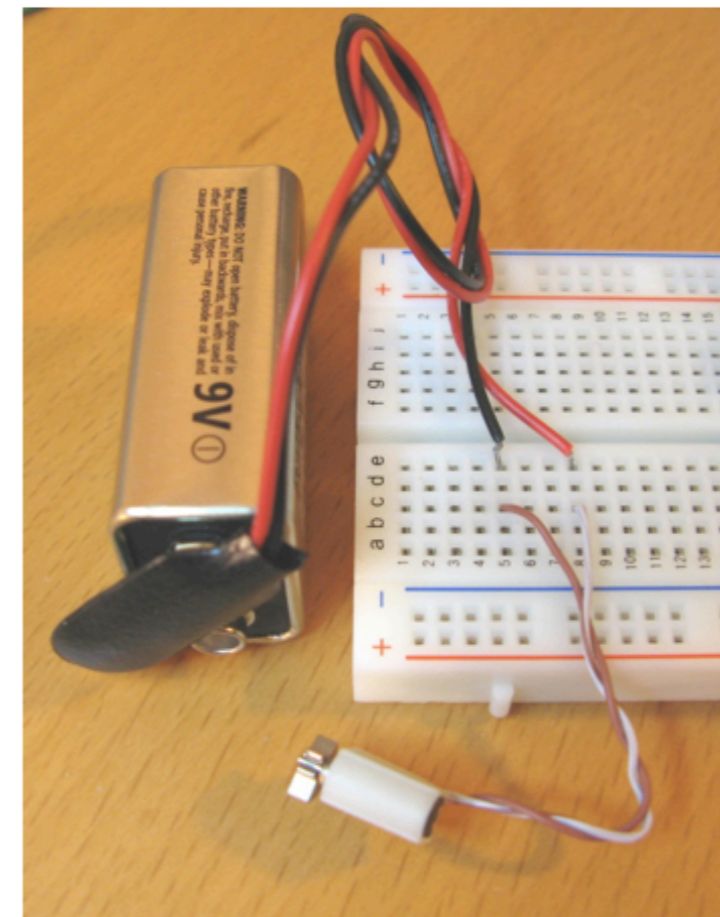
- They come in all forms and sizes.
- With or without gears
 - How much juice it needs to spin?
 - How fast it spins
 - How strong it spins
 - Size, shaft diameter, shaft length,...

How to connect a DC motor?

To drive them, apply a voltage
The higher the voltage, the faster the spinning



polarity determines which way it rotates

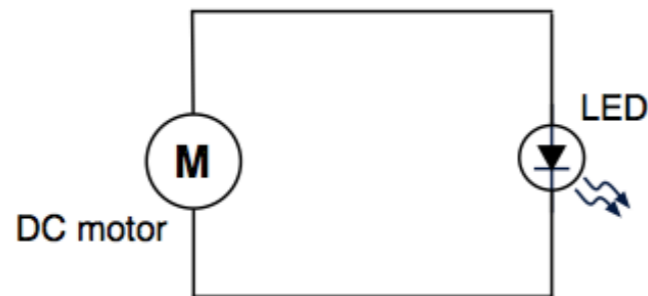


Try this out real quick.
Then swap polarity



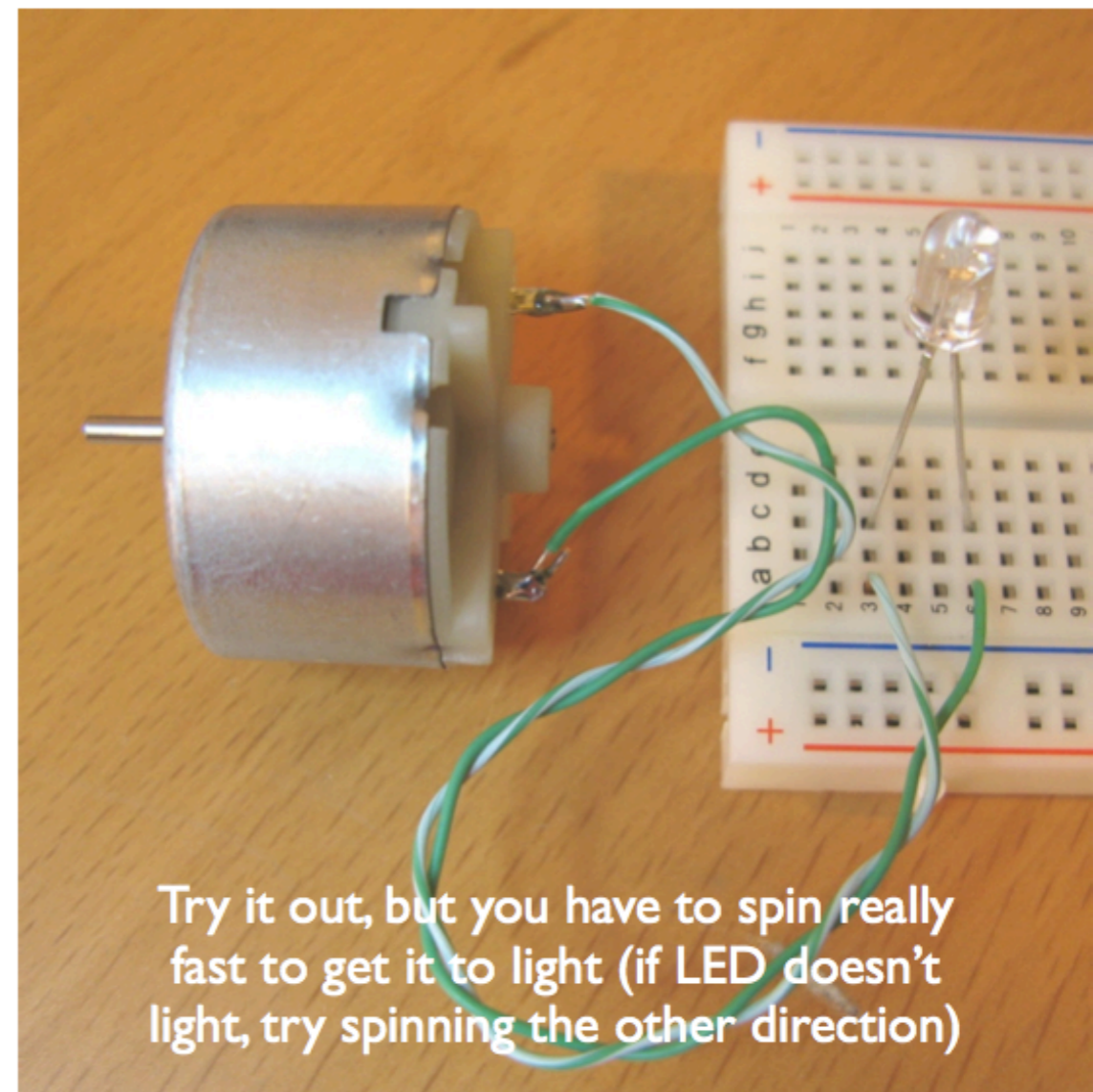
DC motors as generators

Just as voltage causes rotation...

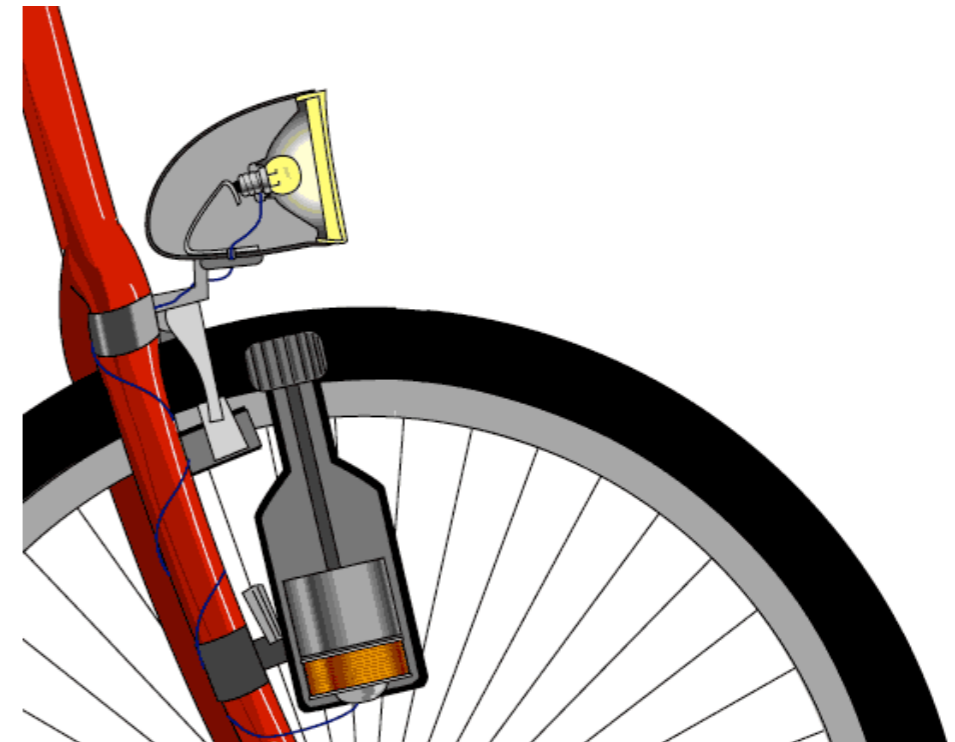
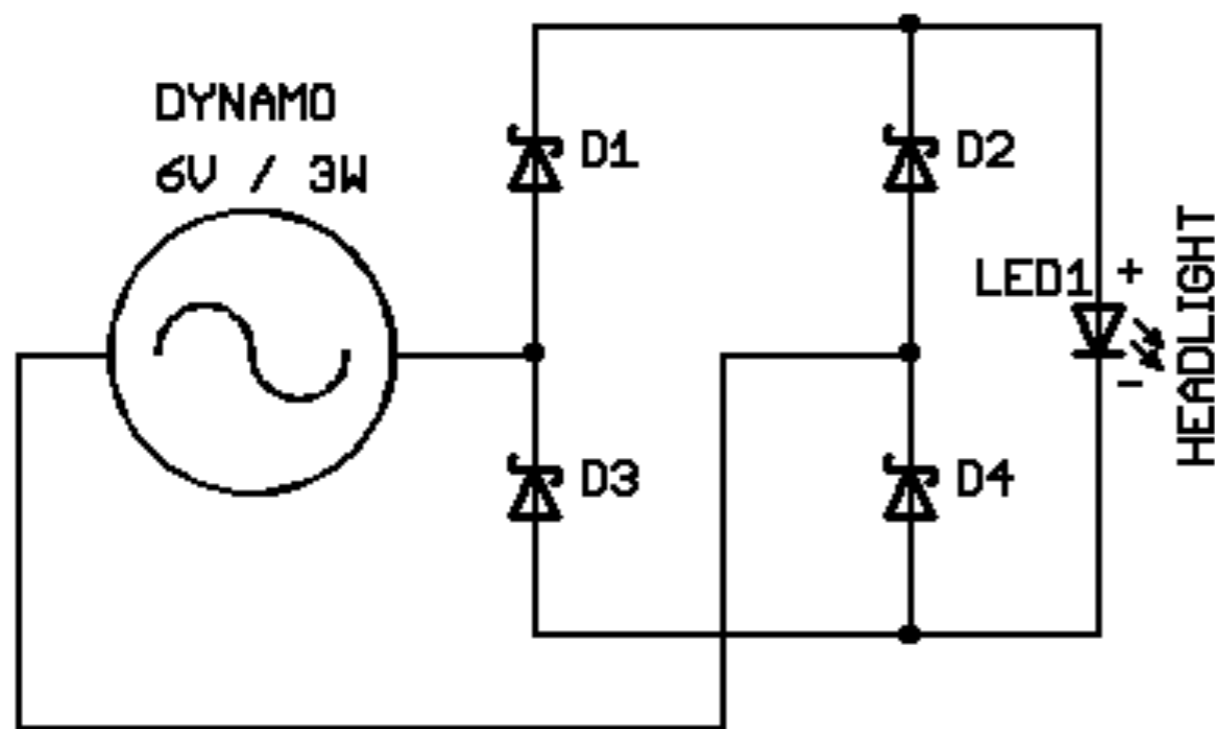


...rotation causes voltage

This is used for “regenerative braking” in electric & hybrid cars



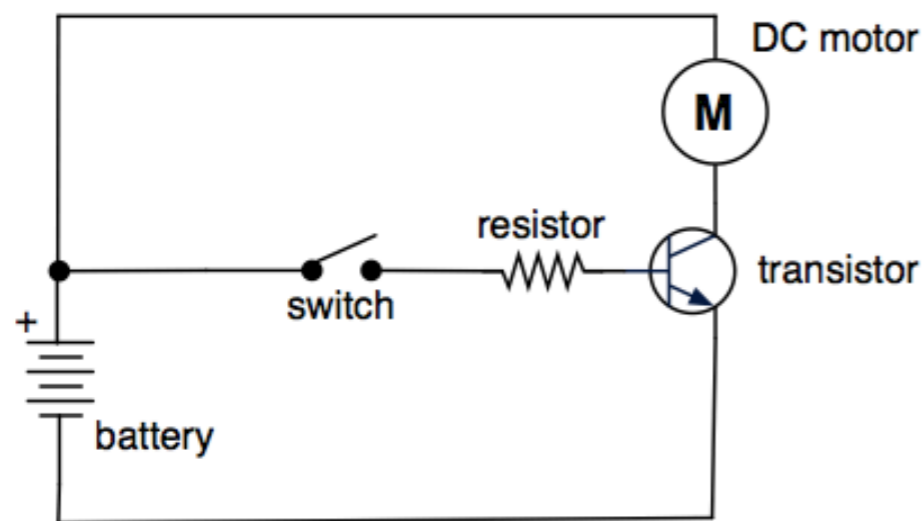
Same idea as a dynamo



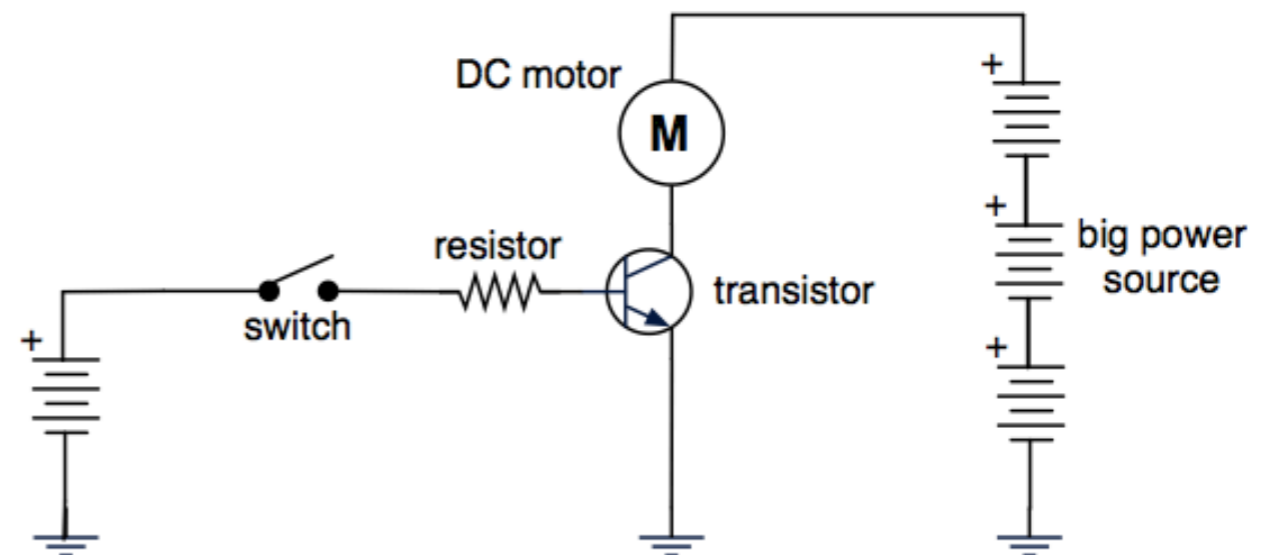
Transistors and motors

- Transistors are small switches. A little juice in once leg, will close the switch.

little motor



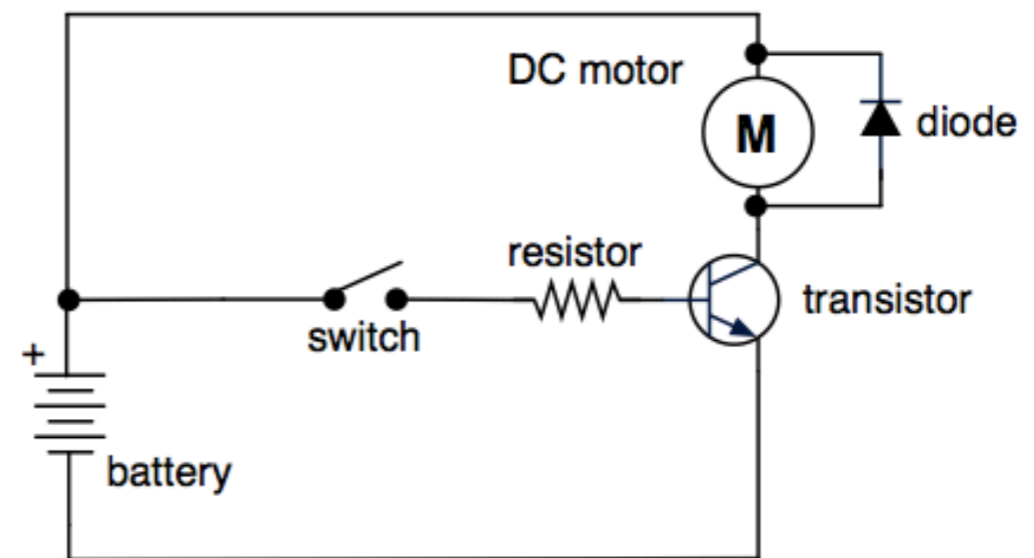
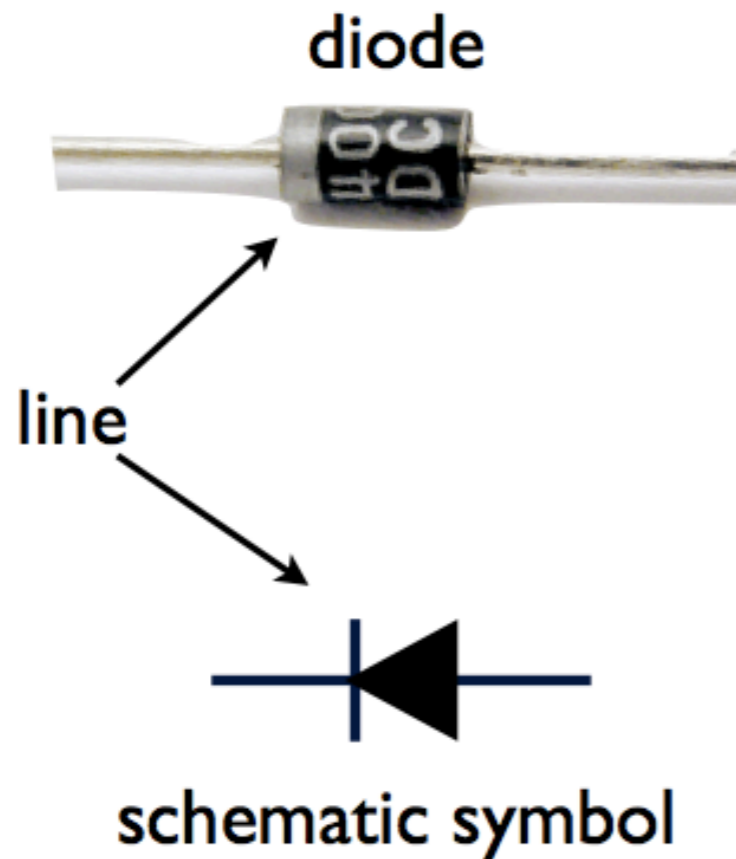
big motor



switching a different power source

- Transistors switch big signals with small signals.

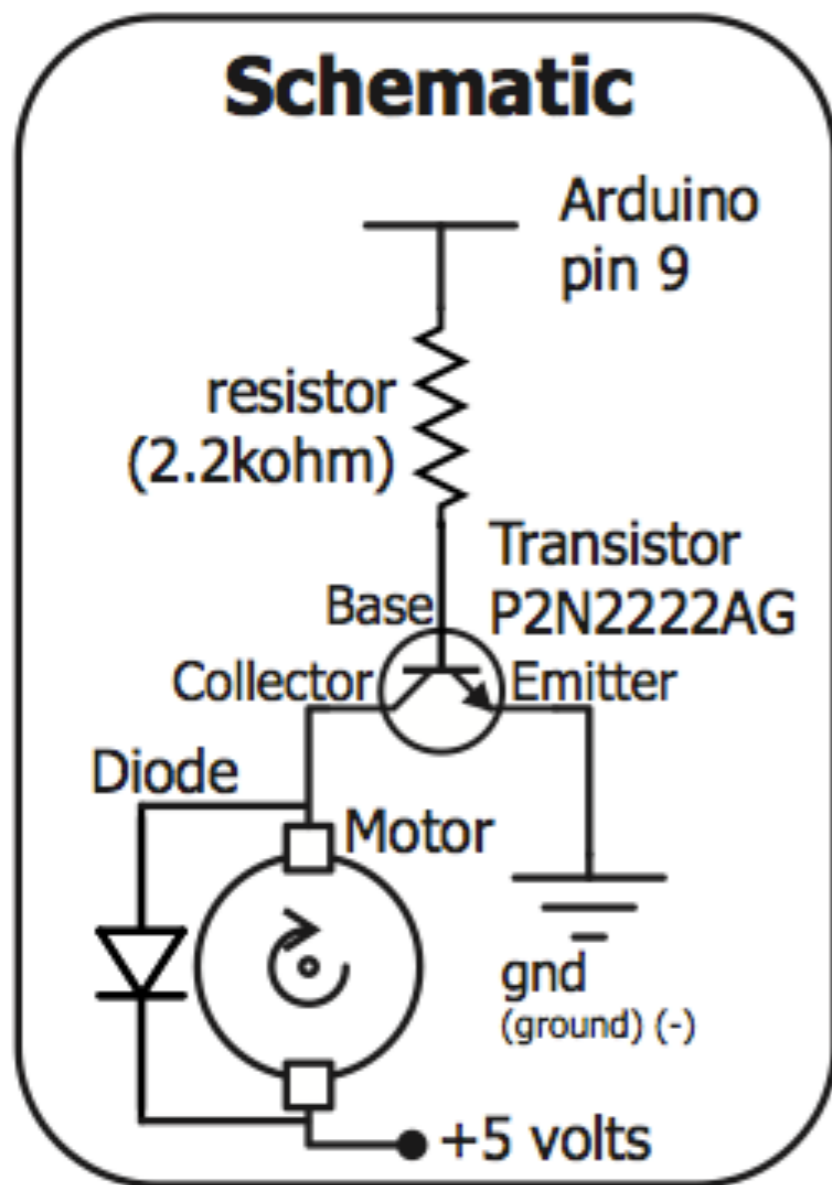
Protecting your circuit



- Since motors can act like generators, need to prevent them from generating juice back into the circuit.



Run a DC motor



```
const int DCMotorpin=9;
void setup()
{
    pinMode(DCMotorpin, OUTPUT);
};

void loop() {
    analogWrite(DCMotorpin,200);
};
```

- Implement the DC motor circuit and run it. Change the analog values, for different speeds.
- Adjust the speed of the motor using a potentiometer.
- Adjust the speed of the motor using any other resistive sensor.