IAT 884
Lab 6
Alternate Output: Motors and Actuation

Preparation:

In *Programming Interactivity* Read:

A. Motors (p. 380 -391)
   Solenoids (p. 417 – 420)

Resources

Servo Library:
http://www.arduino.cc/en/Reference/Servo

Transistor Basics:
http://www.kpsec.freeuk.com/trancirc.htm

Working with Transistors:
http://www.kpsec.freeuk.com/components/tran.htm

Controlling High Current Loads with a Transistor:
http://itp.nyu.edu/physcomp/Tutorials/HighCurrentLoads

H-Bridge Basics:
http://www.modularcircuits.com/h-bridge_secrets1.htm

Servo Motor Resources
http://itp.nyu.edu/physcomp/Labs/Servo

http://www.arduino.cc/playground/ComponentLib/Servo

http://www.seattlerobotics.org/guide/servos.html

IAT884
Lab 6
Alternate Output: Motors and Actuation

In Class Activities:

Equipment:
Arduino
Servo Motor
DC Motor
12V AC Adapter
Power Plug
Voltage Regulator (5v)
Potentiometer
NPN Transistors (TIP 120)
Capacitors (1mf or 10mf)
Diode
Resistors (1k)
Wires
Breadboard

Warning: Make sure that all your components share a common ground!!!! This is extremely important when using two power sources. You will blow a transistor or possibly the Arduino Board if you do not do this.
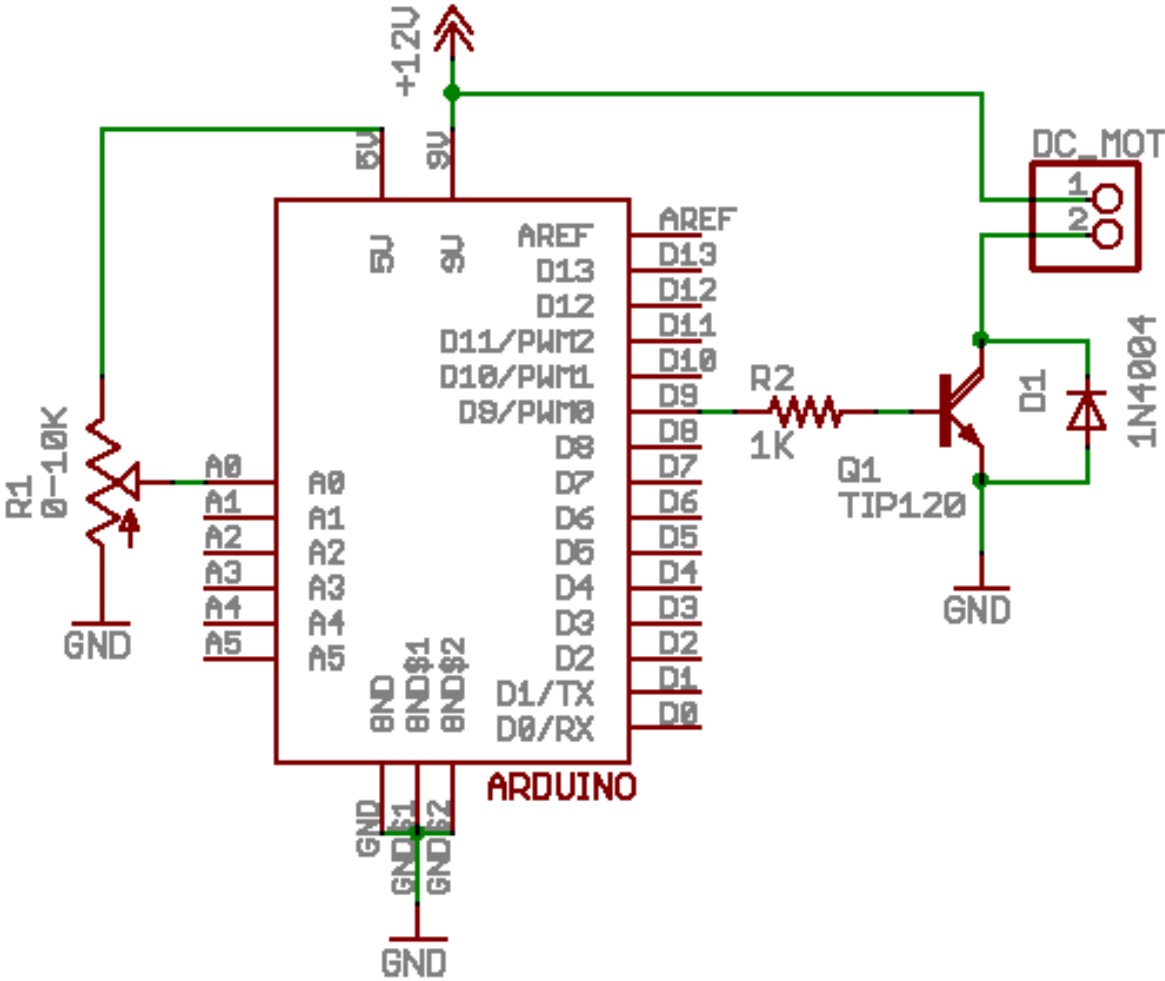
A. Design a circuit that uses a potentiometer to control a DC Motor. You need to use a 12 volt adapter as a separate power source for the motor and an NPN transistor to switch the current. You will need to use a voltage regulator to bring the voltage supplied to the motor down to 5v and a diode to prevent back current.

- *Step 1: Attach Potentiometer (and test functionality using serial window)*
- *Step 2: Build Voltage Regulator circuit to power motor (test with multi-meter)*
- *Step 3: Finish circuit by adding transistor, Diode, and motor elements.*
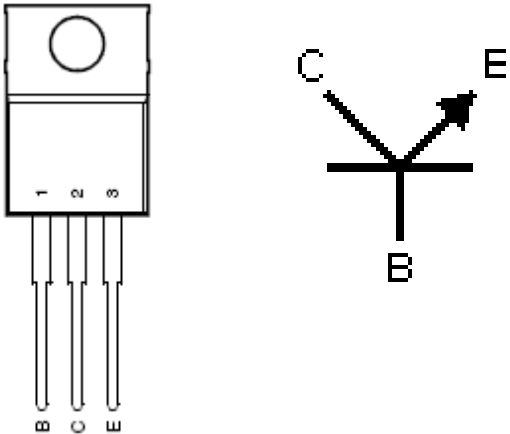
B. Design a circuit to control a servo motor. Use the potentiometer from your previous circuit to control the position of the servo. Use the AC adapter to power the Arduino board to ensure that you have enough power for the system and to make it more portable. You can use the software servo library included with the Arduino software.

- *Step 1: Attach AC adapter to Arduino Board and adjust pin for external power.*
- *Step 2: Make sure potentiometer is working and check output range.*
- *Step 3: Convert incoming value from the potentiometer to a value between 0 – 180 to correspond to the angle of the servo [Map() function]*
- *Step 4: Attach servo*

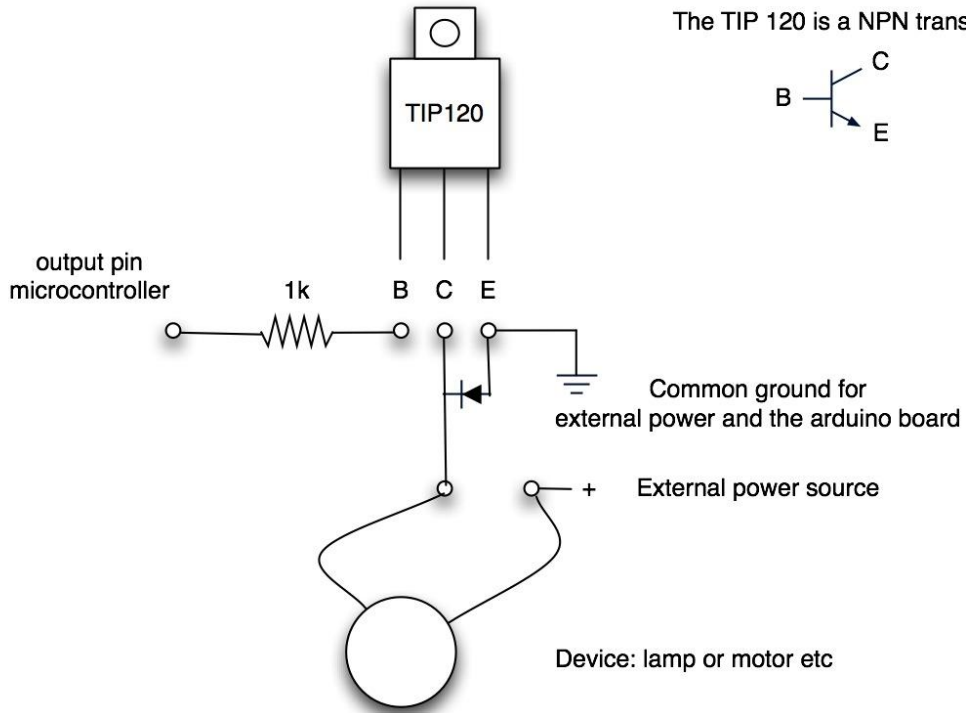# Schematic: Controlling DC motor speed using a potentiometer

+12U

R1
0-10K

GND

ARDUINO

5U
9U

AREF
D13
D12
D11/PWM2
D10/PWM1
D9/PWM0
D8
D7
D6
D5
D4
D3
D2
D1/TX
D0/RX

A0
A1
A2
A3
A4
A5

A0
A1
A2
A3
A4
A5

GND
GND$1
GND$2

AREF
D13
D12
D11
D10
D9
D8
D7
D6
D5
D4
D3
D2
D1
D0

R2
1K

Q1
TIP120

DC_MOT
1
2

D1
1N4004

GND

GND$1
GND$2

GND

NPN Transistor Usage

C   E

B

1 2 3

B C E

Terminal Connections:

- Base is connected to a control voltage (e.g. Microcontroller output)

- The Collector is attached to the negative terminal of the load (e.g. motor or light)

- The Emitter is connected to the common ground

Illustrated DC Motor Circuit

TIP120

The TIP 120 is a NPN transistor

C

B

E

output pin
microcontroller

1k

B   C   E

Common ground for
external power and the arduino board

+   External power source

Device: lamp or motor etc

Base to microcontroller
Emitter to ground
Collector to device

Diode from E to C when connected to inductive load like a DC motor

DC Motor Circuit Attached to an Arduino