IAT 884
Alternate Output: Motors and Actuation

Preparation:

READ: Hartman: CH. 8 (Motors)
READ (optional): Hartman: CH. 8 (Light & Sound)
READ (review): Essential Electronics Concepts - POWER! (on Wiki)
READ (review): Basic Components – Diodes, Transistors, & Relays (on Wiki)

Deprecated:
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

http://www.arduino.cc/en/Tutorial/Potentiometer

In Class Activities:

Equipment:
Arduino
Servo Motor
DC Motor
4AA Battery Pack (alternatively a 12volt adapter)
Power Plug
Voltage Regulator (5v)
Potentiometer
NPN Transistors (TIP 120)
Capacitors (1mf or 10mf)
Diode
Resistors (1k)
Wires
Breadboard

Heads Up!! Make sure that all your components share a common ground!!!! This is extremely important when using two power sources. You might blow a transistor or Arduino if you do not do this, but more likely, it just won't work.

A. Design a circuit that uses a potentiometer to control a DC Motor. You need to use a 4AA battery pack or 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: Unplug from USB, finish circuit by adding transistor and motor elements.
Step 4: Attach AC adapter to Arduino Board to power

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.
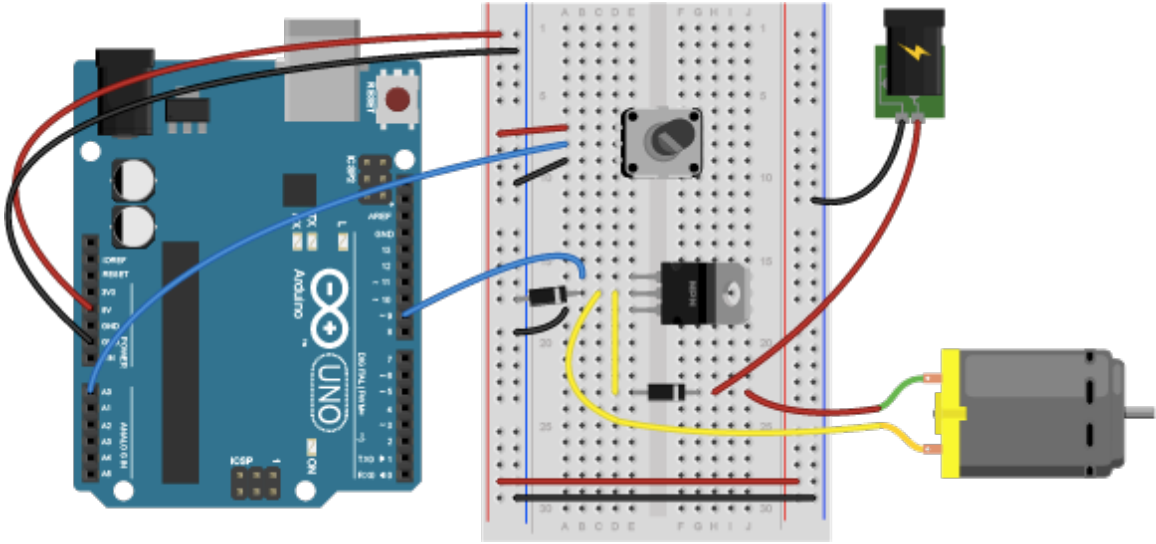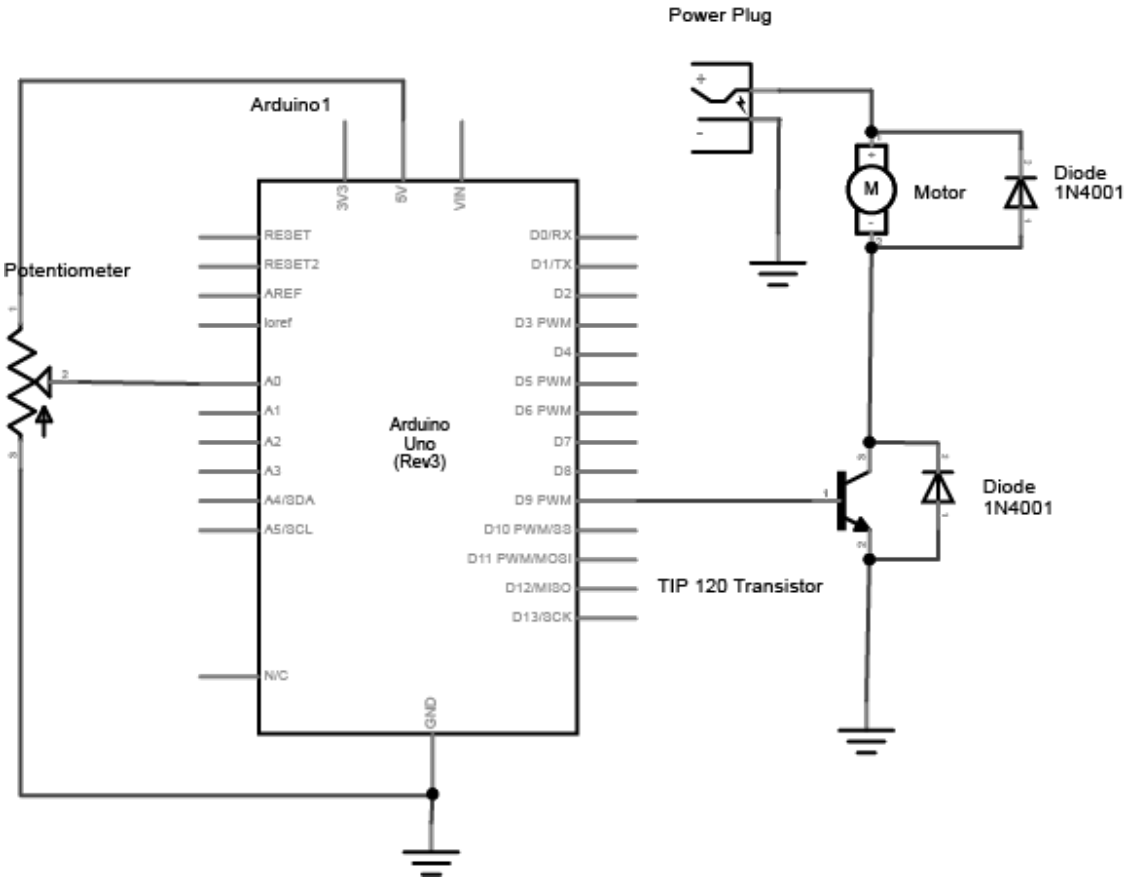
Step 1: Make sure potentiometer is working and check output range.
Step 2: Convert incoming value from the potentiometer to a value between 0 – 180 to correspond to the angle of the servo
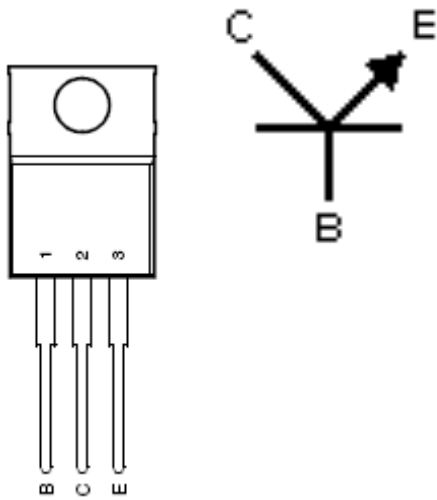*Step 3: Unplug from USB, and attach servo motor*
Step 4: Attach AC adapter to Arduino Board to power

Schematic: Controlling DC motor speed using a potentiometer (don't forget voltage regulator)

Power Plug

Arduino1

Potentiometer

Arduino Uno (Rev3)

Left pins	Right pins
RESET	D0/RX
RESET2	D1/TX
AREF	D2
Ioref	D3 PWM
	D4
A0	D5 PWM
A1	D6 PWM
A2	D7
A3	D8
A4/SDA	D9 PWM
A5/SCL	D10 PWM/SS
	D11 PWM/MOSI
	D12/MISO
	D13/SCK
N/C	

3V3 5V VIN GND

Motor   M

Diode 1N4001

Diode 1N4001

TIP 120 Transistor

NPN Transistor Usage

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 Servo Motor Circuit