Sharp IR Range Finder (GP2D12,GP2D120)

Theory:

Infrared light is transmitted and then reflected back from an object. Based on the angle of reflection, the sensor can figure out distance to that object.

Equations for calculating range(in cm) from Voltage:

Volts = 5/1024*Analog_Reading.

GP2D12: Range = (6787 / (Volts - 3)) – 4

GP2D120: Range = (2914 / (Volts + 5)) – 1

Datasheets

GP2D12

http://www.sharpsma.com/webfm_send/1203

GP2D120

http://www.sharpsma.com/webfm_send/1205

Links

Choosing IR Sensor

http://www.acroname.com/robotics/info/articles/sharp/sharp.html#e8

Sharp IR Theory

http://www.societyofrobots.com/sensors_sharpirrange.shtml

Obstacle Avoiding Car

https://wiki.engr.illinois.edu/display/ae498mpa/The+Sharp+GP2D12+Infrared+Range+Finder

Arduino Tutorial

http://luckylarry.co.uk/arduino-projects/arduino-using-a-sharp-ir-sensor-for-distance-calculation/

Robot using IR Rangefinder

http://bunedoggle.com/robots.php

Sample Code

```
//Rangefinder on Pin #1
int IRpin = 1;
void setup() {
   pinMode(IRpin,INPUT);
    Serial.begin(9600);
}
void loop() {
    int volts = analogRead(IRpin);
    int distance = (6787 / (volts - 3)) – 4;

    Serial.println(distance);
    delay(100);  //100mS delay
}
```

Specs:

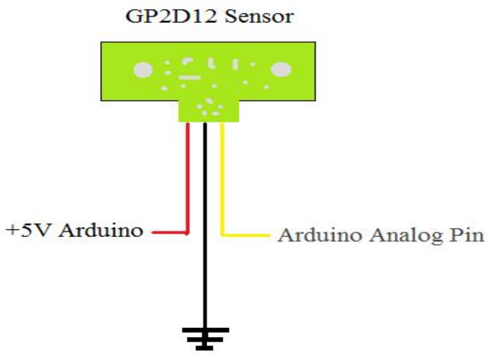
Supply Voltage:	4.5V to 5.5V
Supply Current:	33 to 50 mA
Output:	Analog Voltage
Detection Range:	
	10cm to 80cm(GP2D12)
	4cm to 30cm(GP2D120)

http://www.hvwtech.com

Common Problems and Resolutions

1. Don't use in direct or indirect sunlight
2. Don't use reflective objects
3. Be sure to be within the acceptabl range
4. The linear equations don't work below/above the detection range
5. Wait at least 40mS before reading the same sensor again

Circuit



PING Ultrasonic Sensor

Theory:

Ultrasonic sound is emitted and then the sensor waits for the sound to bounce back from an object. The total round trip time translates into distance, since the speed of sound is known. To transmit ultrasonic sound, send a 2 µS high pulse.

Equation for calculating range(in cm) from duration of round trip

```
Range = Round_trip/ 29 / 2
```

Datasheets

http://www.parallax.com/Portals/0/Downloads/docs/prod/acc/28015-PING-v1.6.pdf

Links

Ping Ultrasonic Tutorial
http://arduino.cc/en/Tutorial/Ping?from=Tutorial.UltrasoundSensor
Sonar Theremin
http://alandtech.blogspot.com/2007/12/arduino-theremin.html
RumbleBot
http://dinofab.com/rumblebot.html
Make an Obstacle Avoiding Robot
http://www.instructables.com/id/How-to-Make-an-Obstacles-Avoiding-Robot-Arduino-S/

Sample Code

//Sonar on Pin #7

```
const int pingPin = 7;

  long duration, cm;
  pinMode(pingPin, OUTPUT);
  digitalWrite(pingPin, LOW);
  delayMicroseconds(2);
  digitalWrite(pingPin, HIGH);
  delayMicroseconds(5);
  digitalWrite(pingPin, LOW);

  pinMode(pingPin, INPUT);
  duration = pulseIn(pingPin, HIGH);
  cm = duration/29/2; // 29 µS/ cm
```

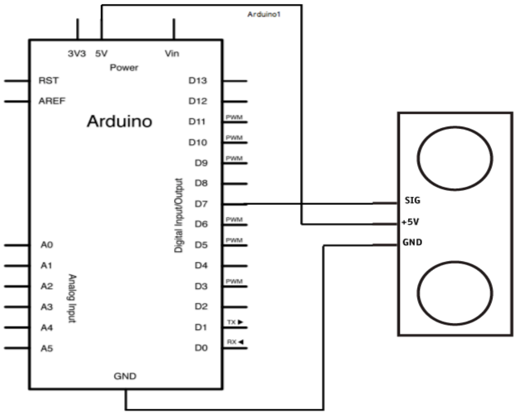
Specs:

Supply Voltage:	4.5V to 5.5V
Supply Current:	30 to 35 mA
Output:	Digital Pulse
Detection Range:	2cm to 300cm

Common Problems and Resolutions

1. Temperature affects the speed of sound. Take it into account if you want a lot of accuracy.
2. Avoid foam objects(they absorb sound waves)
3. Be sure to be within the acceptabl range
4. The linear equations don't work below/above the detection range
5. Avoid using multiple sonars at the same exact moment (sound intereference)

Circuit



Switch

Theory:
Pushing or sliding closes the switch and short circuits the two sides of the switch to each other. Also known as a momentary switch.
Use a 10k resistor for pullup or pulldown. 50mS should be a good value for debouncing.
IMPORTANT: Read this -
http://www.arduino.cc/en/Tutorial/Debounce

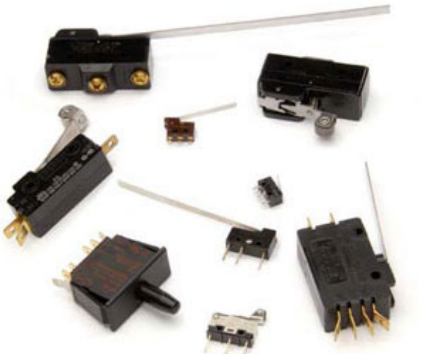
Datasheets
http://www.parallax.com/Portals/0/Downloads/docs/prod/acc/28015-PING-v1.6.pdf

Links
Pushbutton Tutorial
http://www.arduino.cc/en/Tutorial/Pushbutton
Slideswitch Tutorial
http://www.arduino.cc/en/Tutorial/Switch
Mothbot
http://www.instructables.com/id/The-Arduino-Mothbot/

Sample Code

```
int ledPin = 13;
int inPin = 7;
int val = 0;

void setup() {
  pinMode(ledPin, OUTPUT);
  pinMode(inPin, INPUT);
}

void loop(){
  val = digitalRead(inPin);
  if (val == LOW)
    digitalWrite(ledPin, LOW); // LED OFF
  } else {
    digitalWrite(ledPin, HIGH);  //LED ON
  }
}
```

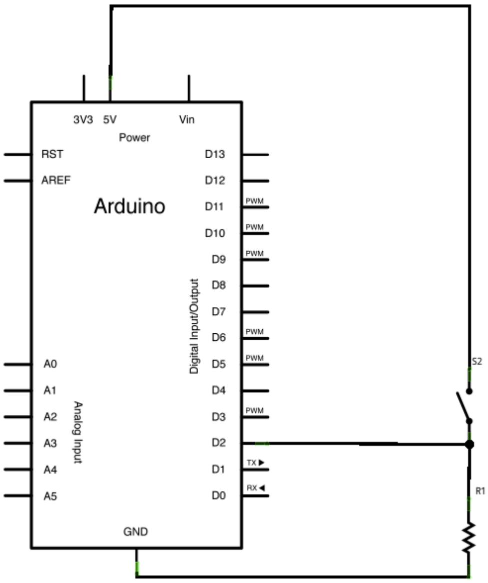
Specs:



Common Problems and Resolutions

1. Debouncing is a major issue
2. Be sure to use a pulldown or pullu resistor to avoid floating
3. Be sure to stay within your switch electrical limits
4. Remember to declare the switch's pin as an input
5. Know whether your switch is High when closed or when open.

Circuit



Potentiometer

Theory:

Sliding or rotating a potentiometer changes the resistance at the output pins. By inputting voltage and treating the potentiometer (or pot) as a voltage divider

Note: Some potentiometers have a linear relationship between resistance and position, others do not!

Datasheets

Links

Potentiometer Tutorial
http://www.arduino.cc/en/Tutorial/Potentiometer
Analog Input Tutorial
http://www.arduino.cc/en/Tutorial/AnalogInput
DC Motor Control With a Pot
http://luckylarry.co.uk/arduino-projects/arduino-control-a-dc-motor-with-potentiometer-and-multiple-power-supplies/
LED Control with a Pot
http://www.instructables.com/id/arduino-control-leds-with-a-pot-meter/

Sample Code

```
// Potentiometer connected to Pin #2
int val = 0;
int potPin = 2;
pinMode(potPin, INPUT);
val = analogRead(potPin);
```

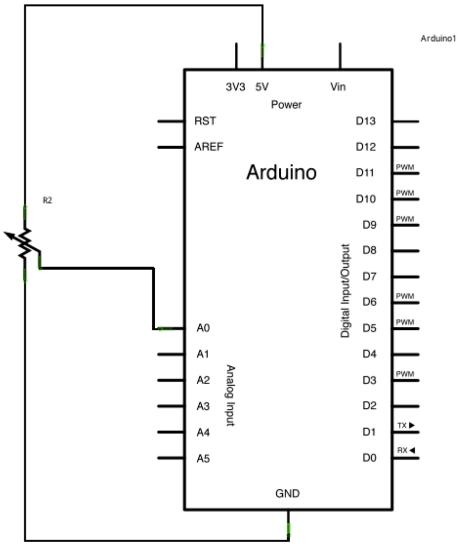
Specs:

Supply Voltage: 5V

Common Problems and Resolutions

1. Many pots do not have a linear relationship
2. Remember to set the potentiomete pin as an Input
3. Don't forget to connect all the pins the pot

Circuit



Accelerometer(ADXL335)

Theory:
Tiny mechanical pieces inside the sensor react to acceleration. The acceleration vector felt on the sensor is separated into X, Y, and Z components. Each component is outputted on its respective channel, in Analog Voltage format.
Accelerometers pick up all accelerations, including gravity. Taking into account all components can provide you with a tilt measurement.

Datasheets

ADXL335
http://www.sparkfun.com/datasheets/Components/SMD/adxl335.pdf

Links

Theory
http://www.societyofrobots.com/sensors_accelerometer.shtml
ADXL335 Tutorial
http://www.arduino.cc/en/Tutorial/ADXL3xx
3D Cube
http://www.pyrofersprojects.com/3dcube.php

Sample Code

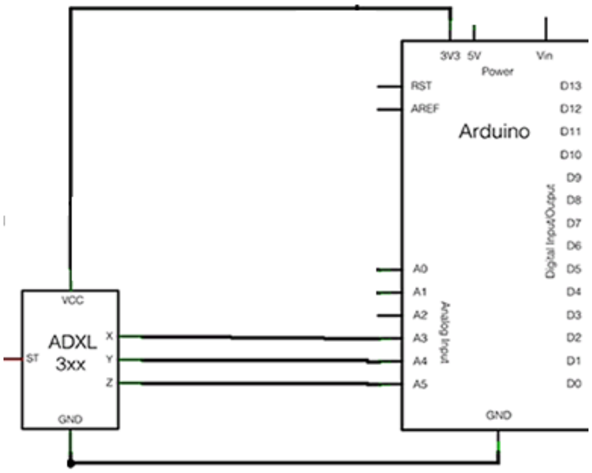
```
// Accelerometer connected to pins A3, A2, A1.
const int xpin = A3;
const int ypin = A2;
const int zpin = A1;

xval = analogRead(xpin);
yval = analogRead(ypin);
zval = analogRead(zpin);
delay(100);
```

Specs:
Supply Voltage:
ADXL335 1.8V to 3.6V
Supply Current: 320uA
Output: Analog Voltage
Detection Range:
3 axis, +-3g(ADXL335)

Common Problems and Resolutions

1. Stay within the voltage supply range
2. DO NOT POWER WITH 5V! (Use 3.3
3. It measures acceleration, you can us for tilt ONLY assuming your object doesn't accelerate

Circuit



LED

Theory:

Pass voltage and current through an LED and it lights up. Most common LEDs draw 20mA nominally. They have a forward voltage of 1.2V, which means they have a 1.2V drop.

(Driving Voltage – Forward Voltage)/LED current = resistor value to use

Resistor value does not have to be precise. For example, if you calculate a 364 ohm resistor, just go ahead and use a 220 ohm or 330 ohm or 470 ohm, doesn't quite matter.

Datasheets

Links

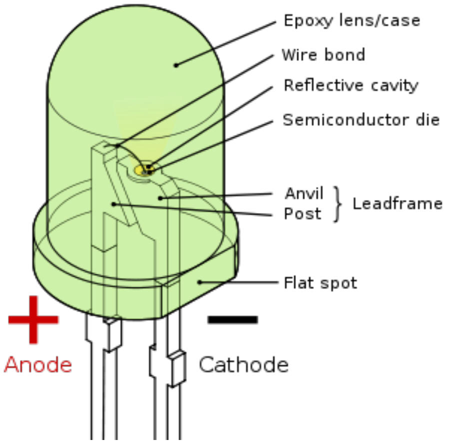
Blink LED Tutorial
http://www.arduino.cc/en/Tutorial/Blink
LED Tutorial
http://www.societyofrobots.com/electronics_led_tutorial.shtml

Sample Code

```
//LED on Pin #13
void setup() {
  pinMode(13, OUTPUT);
}

void loop() {
  digitalWrite(13, HIGH);    // High
  delay(1000);
  digitalWrite(13, LOW);   // Low
  delay(1000);
}
```

Specs:

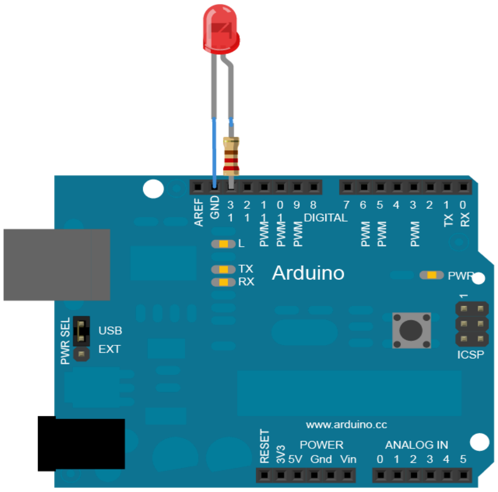
Supply Voltage:	2V to 20V
Supply Current:	20 to 25 mA
Output:	Visible Light



Common Problems and Resolutions

1. Don't connect the LED backwards
2. Be sure to use a resistor!
3. Be sure to be within the acceptabl range
4. Be sure to set the pin as an output

Circuit



Piezo Sensor

Theory:
Basically, a really low power , crude microphone. Force or vibration on the piezo sensor generates voltage.

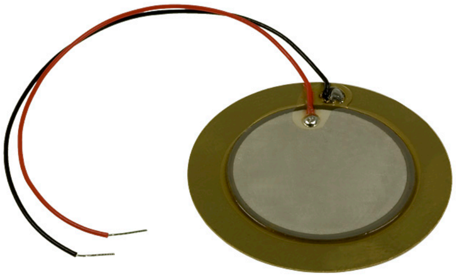
Datasheets

Links
Arduino Tutorial
http://www.arduino.cc/en/Tutorial/KnockSensor
Piezo Effect Theory
http://www.aurelienr.com/electronique/piezo/piezo.pdf

Sample Code

```
int ledPin = 13;
int knockSensor = 0;
byte val = 0;
int THRESHOLD = 100;

void setup() {
 pinMode(ledPin, OUTPUT);
 beginSerial(9600);
}

void loop() {
  val = analogRead(knockSensor);
  if (val >= THRESHOLD) {
    digitalWrite(ledPin,HIGH);//LED On
    printString("Knock!");
  }
  delay(100);  //delay
}
```

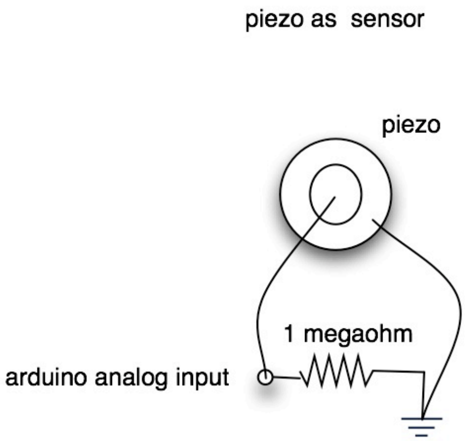
Specs:
Supply Voltage:
5V
Supply Current: 5mA
Output: Analog Voltage
Detection Range:



Common Problems and Resolutions

1. Don’t forget the 1 megaohm resistor
2. Certain piezos aren’t sensitive t weak vibrations

Circuit



Piezo Beeper

Theory:
Applying electricity creates vibration of the piezoelectric plates, producing sound. Give it different frequencies to produce specific sounds, and even music.

Datasheets

Links
Play Melody Arduino
http://www.arduino.cc/en/Tutorial/PlayMelody
Melody Theory
http://arduino.cc/en/Tutorial/Melody
Spooky Sound Project
http://todbot.com/blog/2006/10/29/spooky-arduino-projects-4-and-musical-arduino/
Getting Started with Arduino
http://tronixstuff.wordpress.com/2010/07/24/getting-started-with-arduino-–-chapter%C2%A0thirteen/

Sample Code

```
// Generates a 1500 Hz sound
void setup()
{
     pinMode(11, OUTPUT);   // sets
the pin as output
}
void loop()
{
     analogWrite(11,128); // 50% on
     delay(500);
     digitalWrite(11, LOW);
     delay(500);
}
```

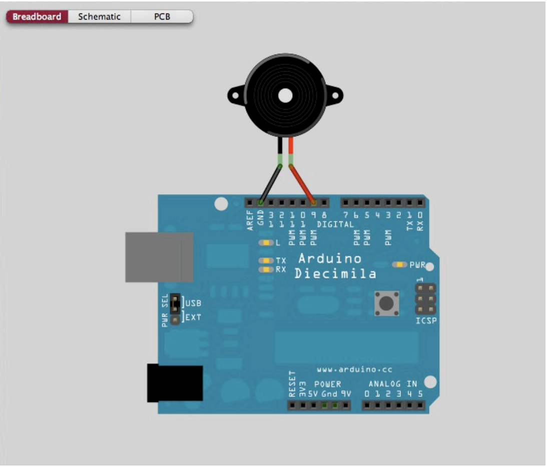
Specs:

Supply Voltage:		
	Hobby	3V – 12V
Supply Current:		20mA
Output:		Sound

Common Problems and Resolutions

1. Stay within the voltage supply range!
2. Make sure you're actually transmitting in the audible huma hearing range

Circuit



XBee

Theory:

All the encoding and reliable wireless communication work is done onboard the Xbee. It's a serial gateway that allows you to transmit UART seamlessly from one device to another (or from device to computer).
NOTE: Remember to set the Xbee firmwares before use

Datasheets

XBee /Xbee Pro
http://ftp1.digi.com/support/documentation/90000976_H.pdf

Links

Common Xbee Problems
http://www.faludi.com/projects/common-xbee-mistakes/
Connecting Xbee to Arduino
http://answers.oreilly.com/topic/2458-how-to-connect-an-arduino-to-an-xbee-radio/
Using the Shield
http://www.arduino.cc/en/Main/ArduinoXbeeShield
Networked On-Air Light
http://makeprojects.com/Project/Networked-On-Air-Light/614/1
Xbee Basics
http://forums.trossenrobotics.com/tutorials/how-to-diy-128/xbee-basics-3259/
Programming Arduino Wirelessly
http://www.faludi.com/itp_coursework/meshnetworking/XBee/XBee_program_Arduino_wireless.html

Sample Code

```
int myData = 0; // define the byte

void setup(){.
    Serial.begin(38400);
}

void loop(){
myData = Serial.read(); // read serial
byte
Serial.print(myData + 1, BYTE); // reply
what we received + 1
}
```

Specs:

Supply Voltage:

Direct	3.3V
Xbee Shield	5V

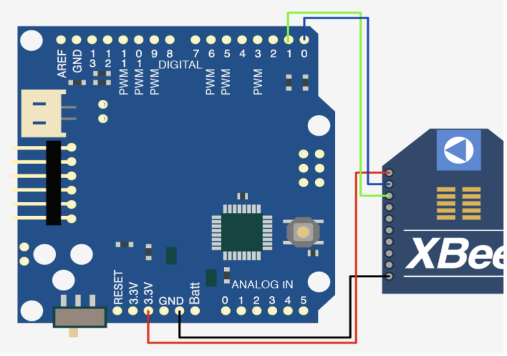
Supply Current: 50mA
Output: UART serial
Range:

1mW	300ft
60mW	1 mile

Common Problems and Resolution

1. Stay within the voltage supply range!
2. Use an Xbee shield or voltage shifter! The Xbee cannot hand 5V level serial directly
3. Be sure to program the correc firmware to each device.
4. Be sure to match baud rates
5. No flow control and no handshaking on the computer side of things

Circuit



BlueSMIRF

Theory:
Basically a Bluetooth Xbee. Serial gateway using Bluetooth as the wireless protocol.
Note: All signal pins are 3.3V to 6V tolerant, so you can connect directly to Arduino

Datasheets
http://www.rovingnetworks.com/documents/RN-41.pdf

Links
BlueSMIRF Tutorial
http://www.sparkfun.com/tutorials/67
Setting up BlueSMIRF
http://inst.eecs.berkeley.edu/~ee192/sp11/design/abe_setup_bluesmirf.pdf
Automatic Cat Feeder
http://www.damonkohler.com/2010/11/android-automated-cat-feeder.html
Linux and Arduino Bluetooth Link
http://www.flickr.com/photos/ricardo_ferreira/4225911933/

Sample Code

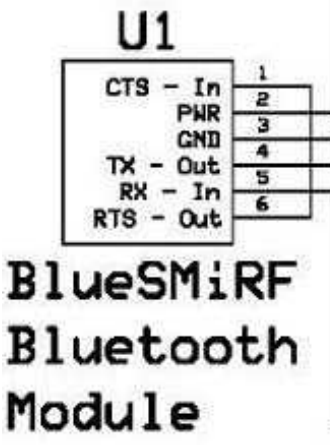
```
int myData = 0; // define the byte

void setup(){.
    Serial.begin(38400);
}

void loop(){
myData = Serial.read(); // read serial
byte
Serial.print(myData + 1, BYTE); //
reply what we received + 1
}
```

Specs:
Supply Voltage:
Silver/Gold 3.3V – 6V
Supply Current: 25mA
Output: UART
Wireless Range:
Gold 100m
Silver 18m

Common Problems and Resolutions

1. Stay within the voltage supply ran
2. Be sure to match up baud rates
3. Stay within the wireless range
4. Be sure to short RTS and CTS if you're not using flow control
5. No flow control and no handshaki on the computer side of things

Circuit



GPS Module

Theory:

GPS receiver listens to satellites and calculates its position on earth in terms of latitude and longitude. Outputs its position in serial data in multiple forms of sentences every second or so. Since it relies on radio frequency, it won't work inside metallic enclosures well and needs a somewhat clear view of the sky.

Datasheets

GPS Module
http://www.parallax.com/Portals/0/Downloads/docs/prod/acc/GPSSensorDatasheetV2.0.pdf

Links

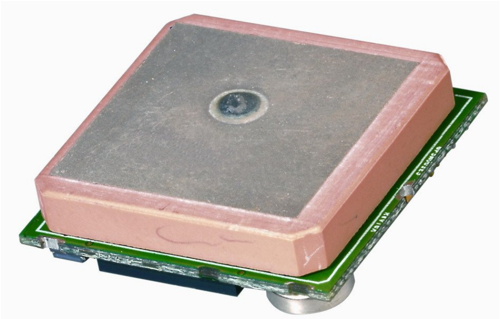
GPS Tutorial
http://www.arduino.cc/playground/Tutorials/GPS
GPS Sentences List
http://www.kh-gps.de/nmea-faq.htm
Arduino GPS System
http://www.seancarney.ca/projects/arduino-gps-receiver/arduino-gps-system
Another GPS system
http://letsmakerobots.com/node/5972

Sample Code

Very different ways of implementing, depending on hardware and what sentences it outputs.
Read this:
http://www.arduino.cc/playground/Tutorials/GPS

Specs:

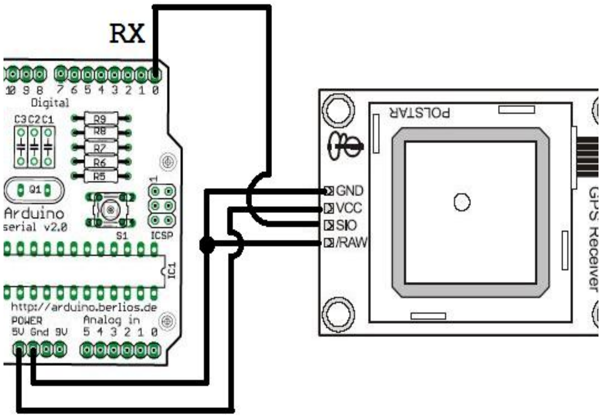
Supply Voltage:	3V – 5V
Supply Current:	40mA
Output:	UART
Baud Rate:	4800(usually) or 9600



Common Problems and Resolutions

1. Stay within the voltage supply range
2. If using a module directly: Do not transmit 5V on the GPS's line, but yo can receive the GPS's output on your 5V AVR line. If you're using a Shield Parallax's GPS – just direct connect.
3. Check the datasheet to see what bau rate its transmitting on(usually 480

Circuit



Photoresistor

Theory:
Light on the photoresistor changes the resistance. More light means less resistance, meaning more current. By connecting the photoresistor to a resistor, we can set up a voltage divider and read the analog voltage.

Datasheets

Links
Theory
http://www.societyofrobots.com/schematics_photoresistor.shtml
Photocells and Braitenberg Vehicle
http://www.ladyada.net/learn/sensors/cds.html
AVR Photovore
http://www.societyofrobots.com/ step_by_step_robot.shtml
Arduino Photovore Robot
http://www.instructables.com/id/First-Arduino-Robot-Light-Seeker/

Sample Code

```
Int cellPin = 0;
int cell;      // the analog
reading from the sensor divider
void setup(void) {
}

void loop(void) {
 cell = analogRead(cellPin);
// invert the reading
  cell = 1023 - cell;
delay(100);
}
```

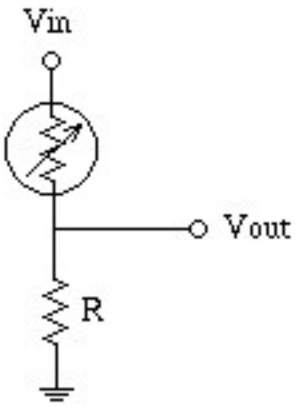
Specs:
Supply Voltage:

Supply Current:
Output: Analog Voltage

Common Problems and Resolutions

1. Be sure to use the correct resistor value

Circuit



Connect Vout to an Analog Pin
Calculate value for R based on resistor
R = sqrt(R_dark*R_bright)

Infrared Phototransistor

Theory:
Basically a transistor whose base is triggered by incident infrared light. Infrared light hitting the phototransistor switches the transistor on, allowing current to pass through. Varying light intensity and frequencies cause the phototransistor to output an analog voltage.
Note: The emitter (e) side of the phototransistor is notched. If your phototransistor has 3 pins, connect the center pin to ground, and

Datasheets
http://www.fairchildsemi.com/ds/QS/QSD123.pdf

Links
Connecting to Arduino
http://sites.google.com/site/therobotronics/arduino/connect-a-phototransistor-to-arduino
Using an Infrared Phototransistor
http://www.instructables.com/id/Use-an-infrared-phototransistor/
Interfacing to an Infrared Remote Control
http://www.arduino.cc/playground/Code/InfraredReceivers
More Infrared Remote Interfacing
http://www.ladyada.net/learn/sensors/ir.html

http://www.pyrofersprojects.com/3dcube.php

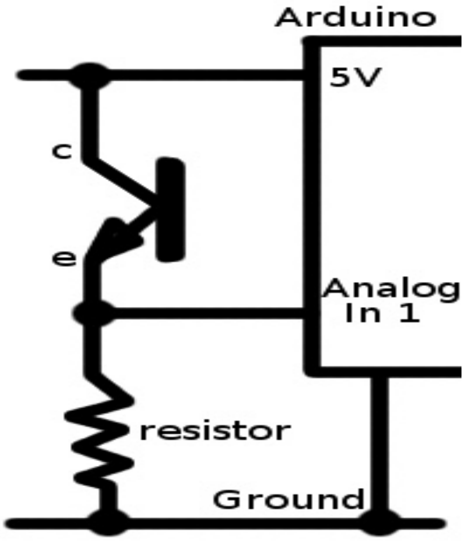
Sample Code
(same as phototransistor)

```
Int cellPin = 0;
int cell;      // the analog
reading from the sensor divider
void setup(void) {
}

void loop(void) {
 cell = analogRead(cellPin);
// invert the reading
  cell = 1023 - cell;
delay(100);
```

Specs:
Supply Voltage:
0-30V
Supply Current:
Output: Analog Voltage
Frequency Response:
Check Part's Datasheet

Common Problems and Resolutions
1. Stay within the voltage supply ran
2. Do not use in sunlight.
3. Be sure to connect the phototransistor the right way

Circuit



Serial LCD

Theory:
LCD that is usually controlled using parallel pins has a microcontroller on board that converts the serial input of an Arduino(or other microcontroller) to the parallel signals.

Datasheets
Sparkfun Serial LCD
http://www.sparkfun.com/datasheets/LCD/SerLCD_V2_5.PDF

Links
Serial LCD Tutorial
http://www.arduino.cc/playground/Learning/SerialLCD
Sparkfun's Serial LCD
http://www.arduino.cc/playground/Learning/SparkFunSerLCD

http://www.societyofrobots.com/sensors_accelerometer.shtml
ADXL335 Tutorial
http://www.arduino.cc/en/Tutorial/ADXL3xx
3D Cube
http://www.pyrofersprojects.com/3dcube.php

Sample Code

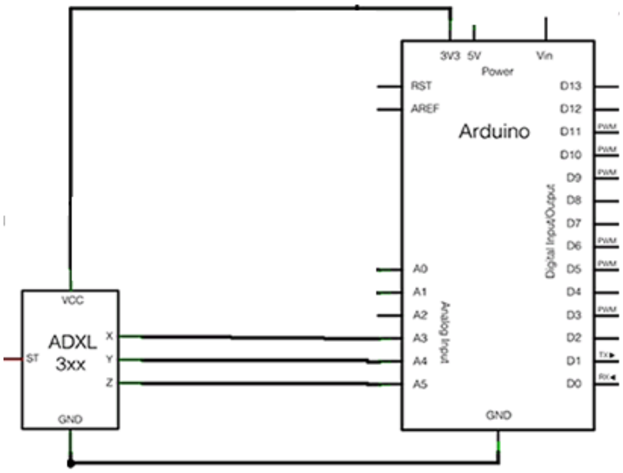
```
// Connect LCD to Arduino's UART
void loop() {
  //backlightOn(0);  // turn the
backlight on all the time

  clearLCD();
  Serial.print(" Hello");
  newLine();
  Serial.print("Arduino");
  delay(5000);  // delay 5 seconds
}
void clearLCD(){
  Serial.print(12, BYTE);
}

void newLine() {
  Serial.print(10, BYTE);
```

Specs:
Supply Voltage:
ADXL335 1.8V to 3.6V
Supply Current: 320uA
Output: Analog Voltage
Detection Range:
3 axis, +-3g(ADXL335)

Common Problems and Resolutions

1. Stay within the voltage supply range!
2. Be sure to match baud rates
3. Be sure to connect the Serial output of the Arduino to the Serial input of LCD

Circuit



Servos

Theory:
A DC motor is geared and has one of the gear's shafts connected to a potentiometer to measure rotational position. A microcontroller inside receives an input control pulse from an external Arduino or other microcontroller and then rotates the motor until the potentiometer says that it reached the desired position

Datasheets

Links
Theory
http://www.societyofrobots.com/actuators_servos.shtml
Single Servo Example
http://www.arduino.cc/playground/Learning/SingleServoExample
Servo Control with Arduino
http://itp.nyu.edu/physcomp/Labs/Servo
Using a Knob to Control Servo
http://www.arduino.cc/en/Tutorial/knob
Arduino Servo Robot
http://www.instructables.com/id/How-to-Make-an-Arduino-Controlled-Servo-Robot-SER/
Robot Arm
http://luckylarry.co.uk/arduino-projects/arduino-robot-arm-larryarm-v0-1/
Animatronic Robot
http://www.narobo.com/robots/freddy/freddy.html

Sample Code

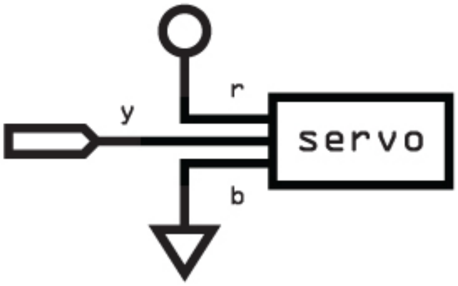
```
// Using the Software Servo (not hardware PWM)
#include <SoftwareServo.h>
SoftwareServo myservo;  // create object

void setup() {
  myservo.attach(2);  // set to pin 2
}

void loop() {
  myservo.write(180); // go to 180 deg
  delay(15);
  SoftwareServo::refresh();
}
```

Specs:
Supply Voltage:
4.8V – 6V
Supply Current: up to 1A
Refresh Rate: 50Hz
Pulse Range:
600uS – 2400uS, 1500uS is cent

Common Problems and Resolutions

1. Stay within the voltage supply ran
2. Do not power with regulated pow supply.

Circuit
Red Wire = power
Yellow Wire = signal in
Black Wire = ground



Modified Servos

Theory:
A servo that has been tricked into thinking its always at the center point(either by gluing the potentiometer to the center or replacing it with a voltage divider). Instead of rotating to specific angles, instead it now rotates at different speeds. For example, if a pulse is sent to go at -90 degrees from center, the servo will constantly turn the motor very quickly (because the potentiometer will never reach that 90 degrees point).

Datasheets

Links
Guide
http://www.acroname.com/robotics/info/ideas/continuous/continuous.html
Tips for Modifying Servos
http://narobo.com/articles/ModServos.html
Continuous Rotation Servo Robot
http://bunedoggle.com/robots.php

Sample Code

```
// Using the Software Servo (not hardware PWM)
#include <SoftwareServo.h>
SoftwareServo myservo;  // create object

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  myservo.attach(2);  // set to pin 2
}

void loop() {
  myservo.write(180); // go to 180 deg
  delay(15);
  SoftwareServo::refresh();
}
```
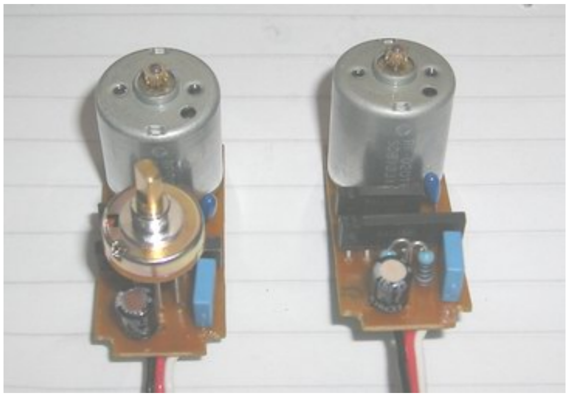
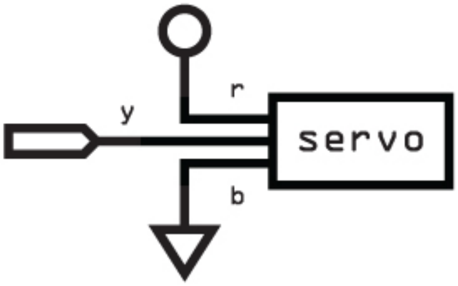

Specs:
Supply Voltage:
4.8V – 6V
Supply Current: up to 1A
Refresh Rate: 50Hz
Pulse Range:
600uS is slowest,
1500uS is stop,
2400us is fastest



Common Problems and Resolutions

1. Use precision(1%) resistors for th voltage divider trick
2. Stay within voltage range
3. Don't break gears when modifying
4. Avoid powering from regulated power supply

Circuit



Wheeled DC Motor (GM Series)

Theory:
Applying voltage and current to a motor makes it spin one way. Changing the polarity of the voltage makes it spin the other direction.
Use this to make a wheeled robot that uses a DC motor.

Note: Use a Transistor, MOSFET, or Motor controller.

Datasheets

Links
Buy Wheel + Motor combo
http://solarbotics.com/products/gmpw_deal/
List of motors – Go Through Specs to See Current and Torque requirements
http://solarbotics.com/motors_accessories/gear_motors/
Gear motor tutorial
http://www.societyofrobots.com/actuators_dcmotors.shtml
Gears Tutorial
http://www.societyofrobots.com/mechanics_gears.shtml

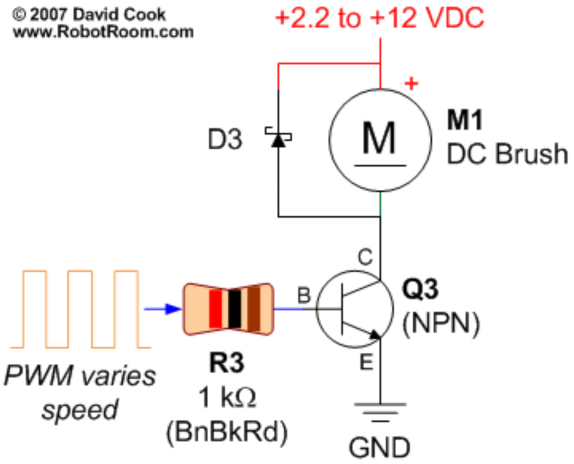
Sample Code

Specs:
Supply Voltage:
Supply Current:
Output:

Common Problems and Resolutions

1. Stay within the voltage supply range!
2. DO NOT power directly from microcontroller pins

Circuit



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Linear Actuator

Theory:
Same theory as DC motor. Instead of rotary motion, instead it's linear motion.

Datasheets

Links
Theory
http://www.societyofrobots.com/actuators_solenoids.shtml
Solenoid Tutorial
http://www.arduino.cc/playground/Learning/SolenoidTutorial
Another tutorial
http://www.instructables.com/id/Controlling-solenoids-with-arduino/
Solenoid Dance Robot
http://makeprojects.com/Project/Spazzi-A-Solenoid-Powered-Dancebot/1074/1

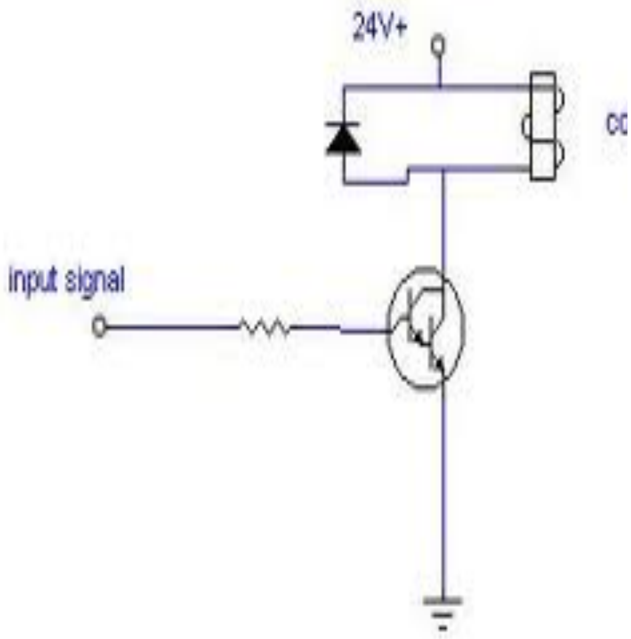
Sample Code

Specs:
Specs:
Supply Voltage:
Supply Current:
Output:

Common Problems and Resolutions

1. Stay within the voltage supply range!
2. DO NOT power directly from microcontroller pins

Circuit



Muscle Wire

Theory:

Datasheets

Links

Muscle Wire Actuator

http://www.instructables.com/id/Screen-Saver-Defeater/step3/Make-the-Nitinol-actuator/

Actuator Example

http://www.rr-cirkits.com/actuator.html

Muscle Wire Arm Example

http://talkingelectronics.com/projects/Nitinol/Nitinol-1.html

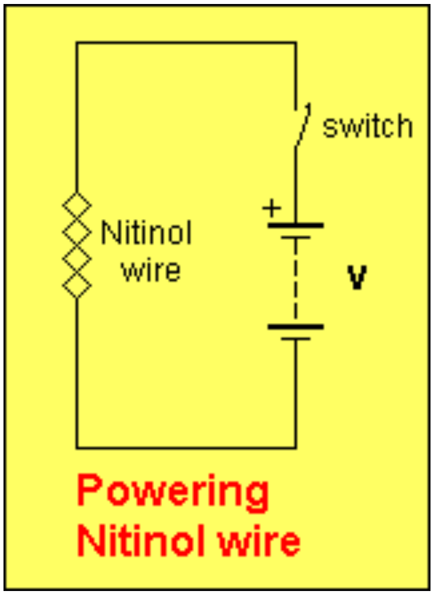
Sample Code

Specs:

Supply Voltage:

Supply Current:

Output:



Common Problems and Resolutions

1. Stay within the voltage supply range!

Circuit

Relay

Theory:
Current flowing through the relay coil, pulls in and closes a switch using magnetic force.

Datasheets

Links
Theory
http://www.kpsec.freeuk.com/components/relay.htm
Using Relays to Control Lights
http://www.glacialwanderer.com/hobbyrobotics/?p=9
Arduino Nerf Gun
http://blog.makezine.com/archive/2010/05/arduino-nerf-sentry-gun-build-relay.html
12V Relay to Arduino Tutorial
http://www.instructables.com/id/Connecting-a-12V-Relay-to-Arduino/

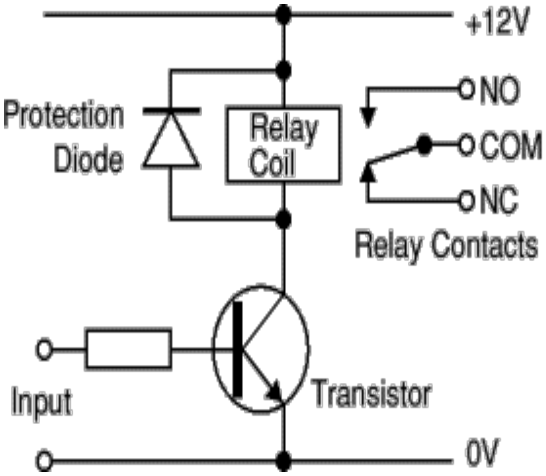
Sample Code

Specs:
Supply Voltage:
Supply Current:
Output:

Common Problems and Resolutions

1. Stay within the voltage supply ran
2. Stay within the current limits

Circuit



Transistor

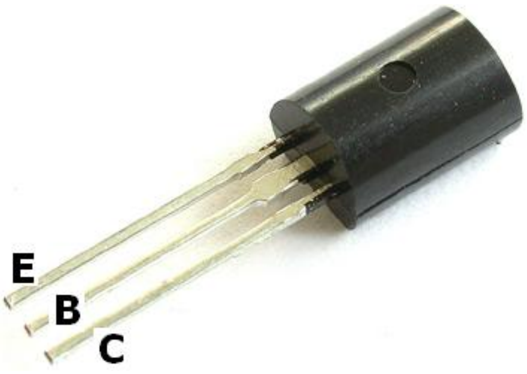
Theory:
A small current at the base, allows a larger current to flow between the emitter and the source
For a NPN transistor, it's a positive voltage at the base allows a larger current to flow.
For a PNP transistor, it's a negative voltage at the base allows a larger current to flow.

Datasheets

Links
Transistor Tutorial(READ THIS!)
http://www.kpsec.freeuk.com/trancirc.htm
Arduino Motor Control with Transistor
http://www.instructables.com/id/Use-Arduino-with-TIP120-transistor-to-control-moto/
Using a transistor as a Switch
http://www.electronics-tutorials.ws/transistor/tran_4.html

Sample Code

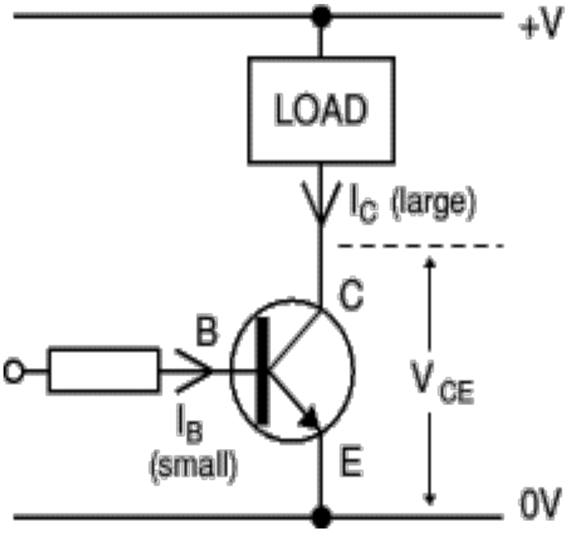
Specs:



Common Problems and Resolutions

1. Stay within the voltage and curren supply range!

Circuit


+V
LOAD
I_C (large)
C
B
I_B
(small)
E
V_{CE}
0V