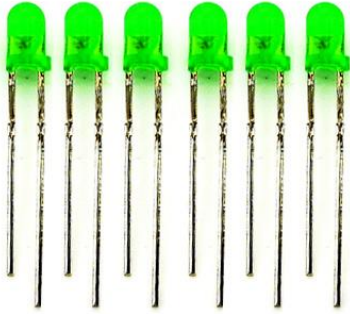# BASICS OF ELECTRONICS

LED

An LED is acronym for Light Emitting Diode, it is a type of diode that illuminates when electricity passes through it. Their voltage drop is higher than a normal diode, from1.2v for an infrared LED, up to 3.5v for blue and ultraviolet LED. These LED's comes in different size and different colours. If you take closer look to that LED picture, one lead (leg) of the LED's shorter and another one is longer. Shorter one is known as cathode (negative (-) symbol) and the longer one is known as anode (positive (+) symbol). If the current passing through the LED is too high, you will lose LED. A LED can withstand up to 3.5v, output voltage from the Arduino pins are 5V to step down this voltage, a resistor in series with LED should use to prevent the LED from hurt.

Resistors

Resist the flow of electrical current in circuit, in other words they limit the flow of electrons. The SI unit of resistance is Ohms, written as the Greek letter omega (Ω). They are often used with the unit prefixes kilo (k) and mega (M). The value of resistor indicated by 4 or 5 colour band bands, using the resistor color code:

The first 2 bands are the first digits of the value, and the 3rd band is the power of ten that comes after those 2 digits. This is also called the multiplier, and is just the number of zeros you have to add. The last band is the tolerance and mostly it will be silver or gold color.

"BB ROY Great Britain Very Good Wife", try to memorise this sentence which allows you to remember 9 color bands in the resistor. First b represents black, second b represents brown, R represents Red, O represents Orange, Y represents yellow, first word in Great G represents Green, first word in Britain B represents Blue, first word in Very V represents violet, first letter in G represents Grey and, first letter in Wife W represents White.

Color	1st Band (1st digit)	2nd Band (2nd digit)	3rd Band (Multiplier)	4th Band (tolerance)
Black	0	0	1Ω	
Brown	1	1	10Ω	±1%
Red	2	2	100Ω	±2%
Orange	3	3	1000 or 1kΩ	
Yellow	4	4	10kΩ	
Green	5	5	100kΩ	±0.5%
Blue	6	6	1MΩ	±0.25%
Violet	7	7	10MΩ	±0.1%
Grey	8	8		±0.05%
White	9	9		
Gold			0.1Ω	±5%
Silver			0.01Ω	±10%

Eg: The first resistor toward right, in the above picture shows Brown RED RED color, First band is Brown look up the table to find 1st digital value for this color, value for the brown color in the first digit is '1', second color is Red, if you look up the table for the 2nd digit value color for the Red is 2 and the third color is also red, if you look up the table for 3rd Band it is multiplier and the value is 100 ohms

If we join all the value together, 1 2 * 100

And the final value will be 1200, the resistance value is 1200 Ω.

Capacitors

These components store and release electrical energy in a circuit. It behaves like a small rechargeable battery. Capacitors are used in filters. The SI unit of capacitance is farad, of F. This is a very large unit and most often, you will see prefixes like pico(p), nano (n) or micro (μ). Often placed across power and ground close to a sensor or motor to help fluctuation in voltage.
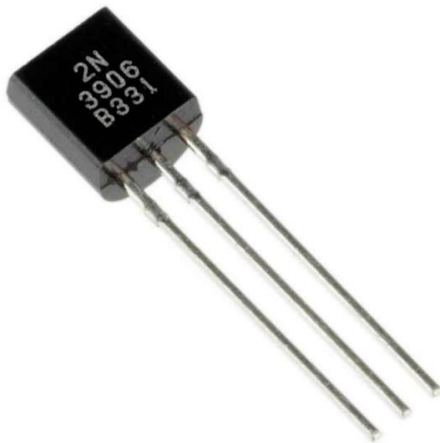
Transistor

A transistor is a semiconductor device, which is used to switch or amplify a signal. You can think of it as a switch that can be operated by using a very weak signal, a current controlled switch.

A transistor has three terminals: they are called the base (B), the emitter (E) and the collector (C).

The emitter 'emits' electrons, and they are 'collected' by the collector. The base is used to control this flow of electrons. If a small current flows from the base to the emitter, a much larger current will flow from the collector to the emitter. How much larger this C-E current is, depends on a constant, specific to the type of transistor. This constant is called the DC current gain, and has the symbol of the Greek letter bèta (β) or Hfe.

E.g. if you have a transistor with $\beta = 100$, and your B-E current = 10mA, your C-E current will be 1A. This principle is used in amplifiers.

However, a transistor cannot keep on amplifying forever: at a certain point, the transistor will just act like a switch.

Diode

Just like a transistor, a diode is a semiconductor device. One of the interesting properties of a diode, is that they only conduct electricity in one direction.

For example, Arduino boards have a diode in series with their power input jack, to prevent you from reversing the power, and damaging the chip.

Diodes have a forward voltage drop ranging from 0.5v to 0.7v. This means that if you measure the voltage before the diode, it will be about 600mV higher than after the Diode, a diode has its limits: if the reverse voltage is too high, it will break, causing it to let current pass in the wrong direction. In some diodes, this is done in a controlled way. These diodes are called zener diodes. They will only conduct if the voltage is higher than a certain value, specific to the zener. This value is constant, so zener diodes are used as a reference in voltage regulators.

Variable Resistor

We have seen about Resistors previously, and the resistor value in those resistors cannot be changed, but in this resistor it is possible to change the resistance value. These resistors comes with three pins. Two pins are connected to the ends of a fixed resistor. The middle pin or wiper moves across the resistor dividing it into two halves. When the external sides of the potentiometer are connected to voltage and ground the middle leg will give the difference in voltage as you turn the knob. This type of resistor also called as potentiometer or Pot. For example if you have a 10k ohms variable resistor, you can vary the resistance from 0 to 10k by rotating the knob. Mostly these type of resistors used with Arduino to control PWM pins available in the Arduino.
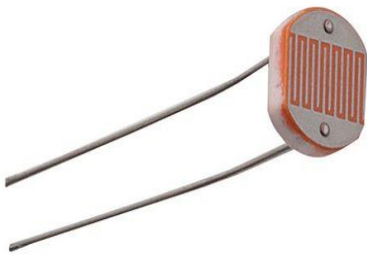
Light Dependent Resistor

As the name suggests these are type of resistor where the resistance change depends on the amount of light falls on the resistor head. This is also known as photo sensor or light sensor, most of the yester years smart products use this simple sensor to do some magic. If you want to make an automatic light controller system it is possible with this sensor. Resistance increase or decrease depends on type of sensor.

DC Motor

A simple motor allow us to experiment with Arduino and work with fun projects. This a simple DC motor which cannot be used for making movable objects, this motor cannot produce necessary torque to move objects that's the reason these motor coupled with gears to increase torque and do some useful work. A motor converts electrical energy into mechanical energy when electricity is applied to its leads.

Push Button

Push button or momentary switch used for giving inputs to Arduino. You can use this device know how signal goes high or low based on the switch state.

Temperature Sensor

Lm35 is an Analog temperature sensor. This sensor can be used with any Arduino analog pins A0 to A5. You have to do an analog read and do some mathematical calculation to change the analog value to Temperature in Celsius or Fahrenheit. You can use any analog type sensor to get a temperature value.
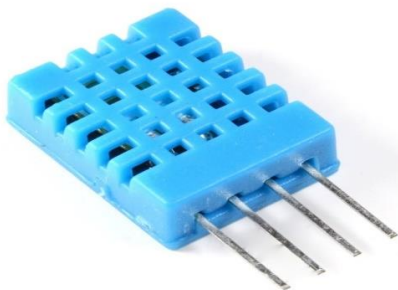
DHT11 Digital Temperature and Humidity Sensor

The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).
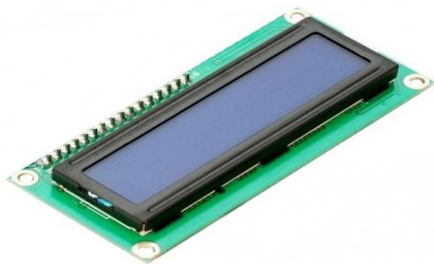
Piezo Buzzer

Piezo buzzer is an electronic device commonly used to produce sound.

Servo Motor

These are special type of motor, these motor are capable of rotating to a precise degree, but these motor can move only from 0 to 180 degree. It is controlled by sending electrical pulses from Arduino.

16x2 LCD display

Liquid display crystal are type of alphanumeric or graphic display based on liquid crystals. These displays are available in many shapes and sizes, most popular are the 16x2 type displays which has 2 rows and capable of display 16 characters on each row.
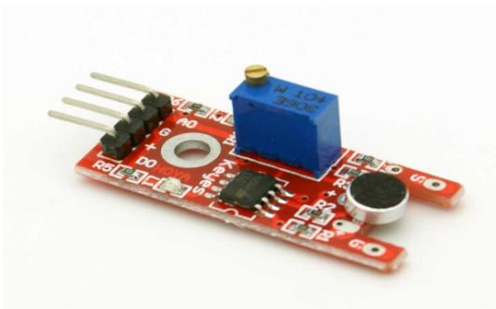
Sound Sensor

These sensor receive sound and covets to electrical pulses. With help of these sensor we can find noise or sound level in a room.
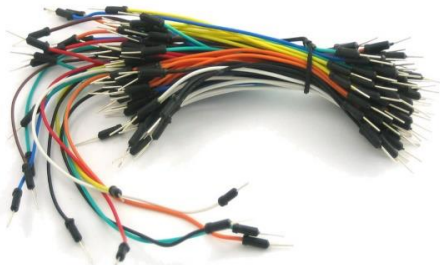
Connecting wires

These wires are very useful connecting different components with Arduino. There are different types of wires available male to male, male to female, female to female. You should have 5 wires from each type for ease of connecting different components with Arduino.
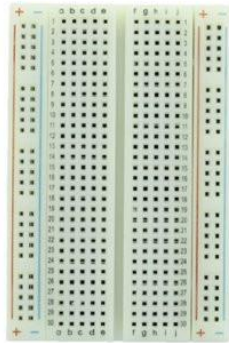
Breadboard

Most important component in any project. This boards allows user to build circuits. It's like a patch panel, with rows of holes that allow you to connect wires and components together. This eliminates the need for soldering of components.