Controlling DC Motors

AVR Tutorial Series

Motor gives power to your MCU. Ya power to do physical works, for example to move your robot. So it is essential to know how to control a DC motor effectively with a MCU. We can control a DC motor easily with microcontrollers. We can start it, stop it or make it go either in clockwise or anti clock wise direction. We can also control its speed but it will be covered in latter tutorials.
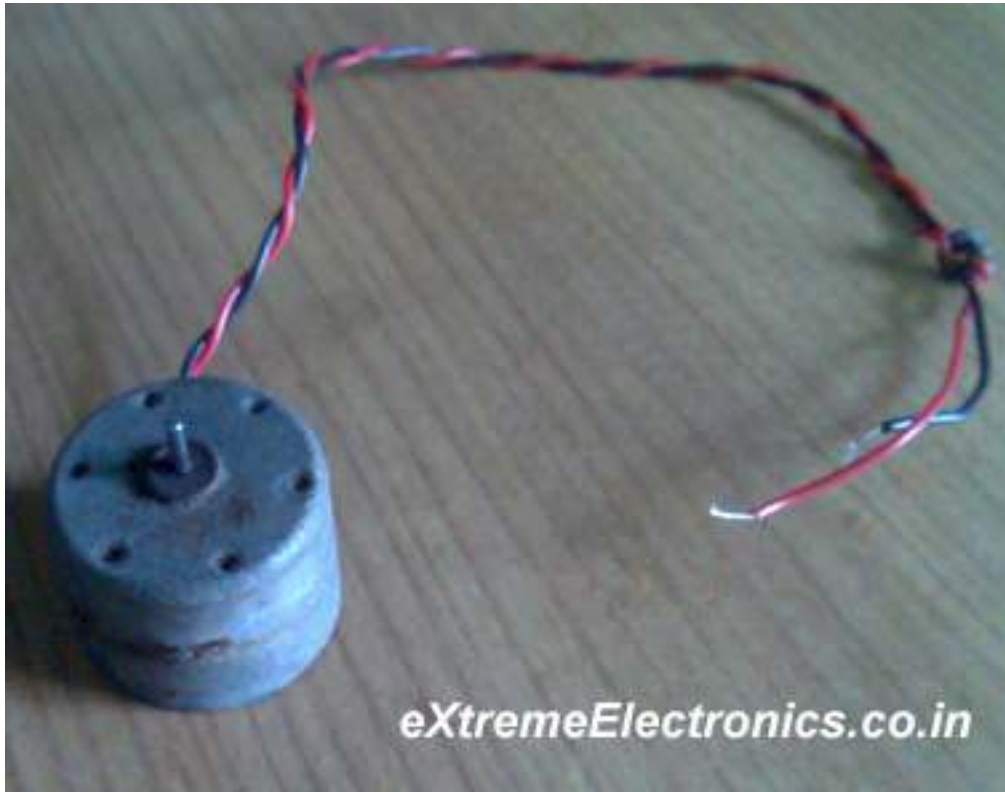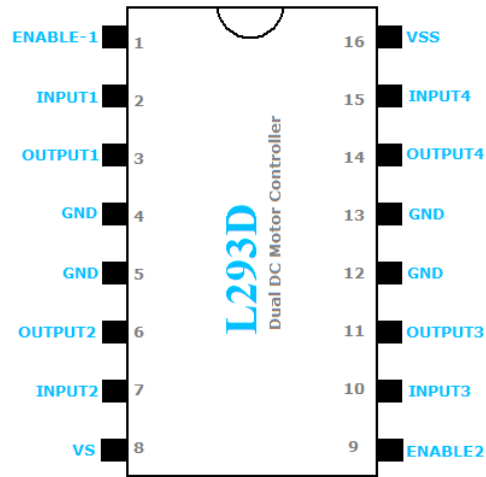

A DC Motor

DC Motor (Intermediate and Advance users can skip this)

A DC motor is electromechanical device that converts electrical energy into mechanical energy that can be used to do many useful works. It can produce mechanical movement like moving the tray of CD/DVD drive in and out (you may like to try it out Go to My Computer, right click the drive icon and click "Eject"). This shows how software controls a motor. DC motors comes in various ratings like 6V and 12V. It has two wires or pins.. When connected with power supply the shaft rotates. You can reverse the direction of rotation by reversing the polarity of input.

Control with MCUs

As the MCUs PORT are not powerful enough to drive DC motors directly so we need some kind of drivers. A very easy and safe is to use popular L293D chips. It is a 16 PIN chip. The pin configuation is as follows.

L293D Dual DC Motor Controller.

This chip is designed to control 2 DC motors. There are 2 INPUT and 2 OUTPUT PINs for each motors. The connections is as follows.
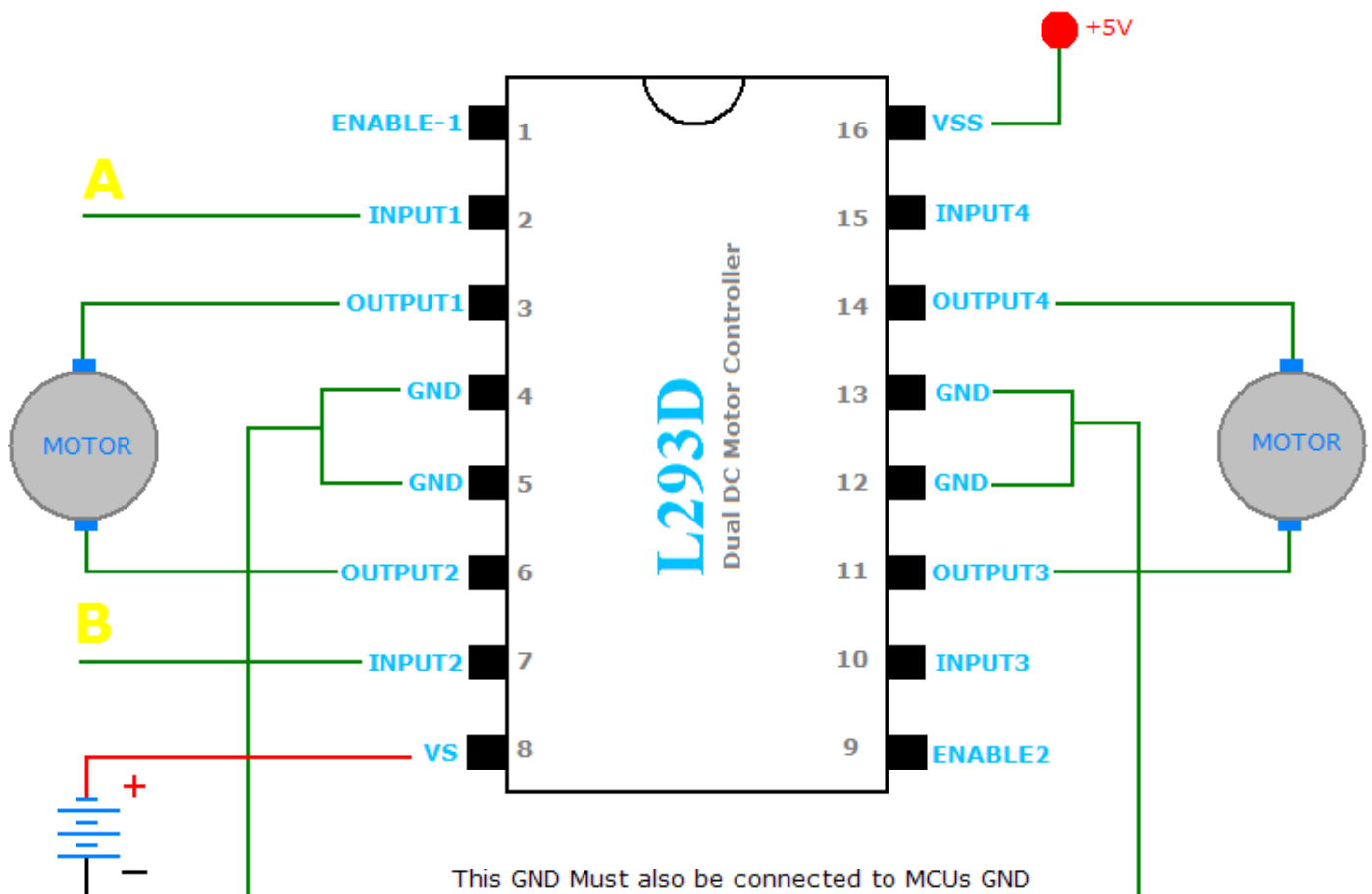
Motor Controller Using L293D

Motor Controller Using L293d chip.

The behavior of motor for various input conditions are as follows

	A	B
Stop	Low	Low
Clockwise	Low	High
Anti Clockwise	High	Low
Stop	High	High

So you saw you just need to set appropriate levels at two PINs of the microcontroller to control the motor. Since this chip controls two DC motors there are two more output pins (**output3 and output4**) and two more input pins(**input3 and input4**). The INPUT3 and INPUT4 controls second motor in the same way as listed above for input A and B. There are also two ENABLE pins they must be **high(+5v)** for operation, if they are pulled low(GND) motors will stop.The following program starts the motor runs it one direction for some time and then reverses the direction.

```c
#include <avr/io.h>
#include <util/delay.h>

void Wait()
{
     char i;
     for (i=0;i<100;i++)
          _delay_loop_2(0);
}

void main()
{
     //Setup port D pin 4,5 as output.
     DDRD=(1<<PD4)|(1<<PD5);

     while(1)
     {
          //Clock wise
          PORTD=0B00010000;
          Wait();

          //Anti clock wise
          PORTD=0B00100000;
          Wait();

          //Stop
          PORTD=0;
          Wait();
     }
}
```

Assembling.

Insert the L293D chip into the breadboard. And connect as per the circuit diagram. Now connect the DC motor. Then connect the 9V supply to the breadboard this supply is used to run he motor. Also connect the 5V supply to the breadboard this is the logical supply i.e. it defines a "HIGH' or "1" is 5V. This 5V is available in the xBoard itself. Use a 2pin connector to access this. Then connect the PD4 and PD5 pins of the MCU to the breadboard. These will provide signals to control the motor. Use a 8 PIN connecter to get PD4 and PD5. **Connect PD4 to 'A' and PD5 to 'B'** Now burn the
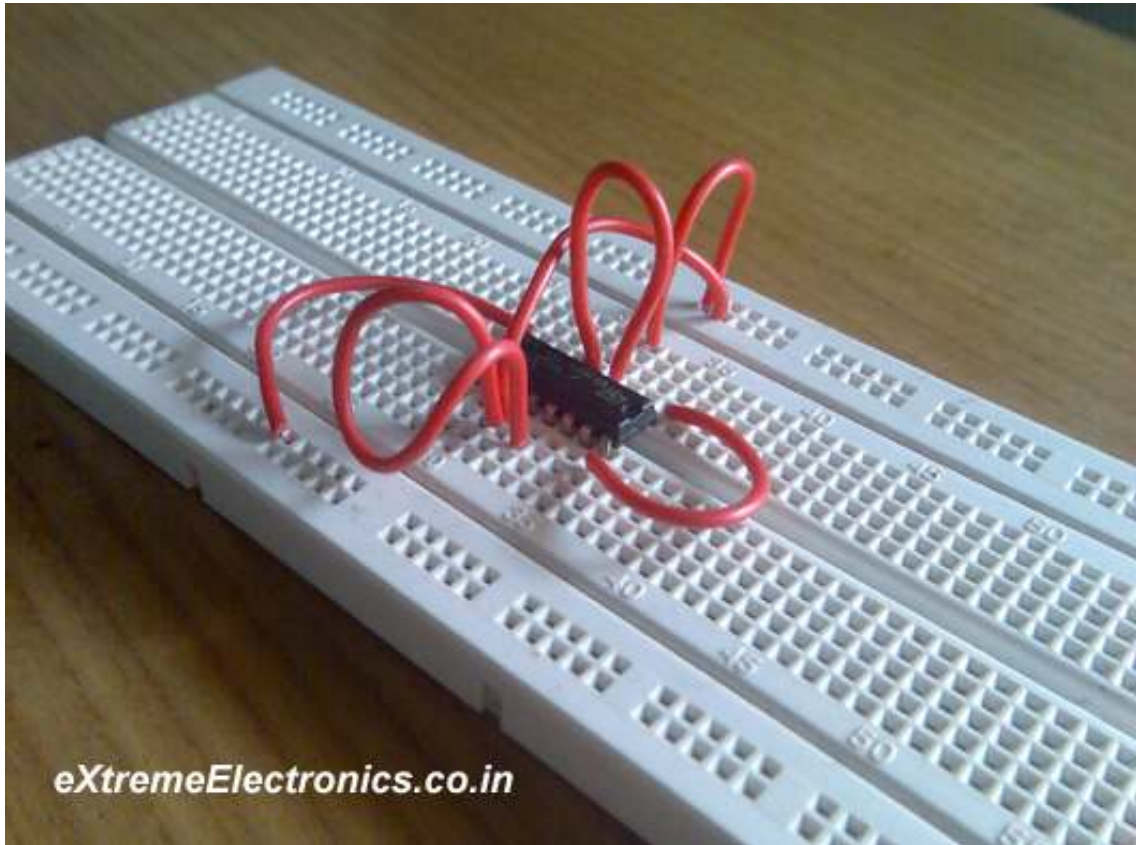
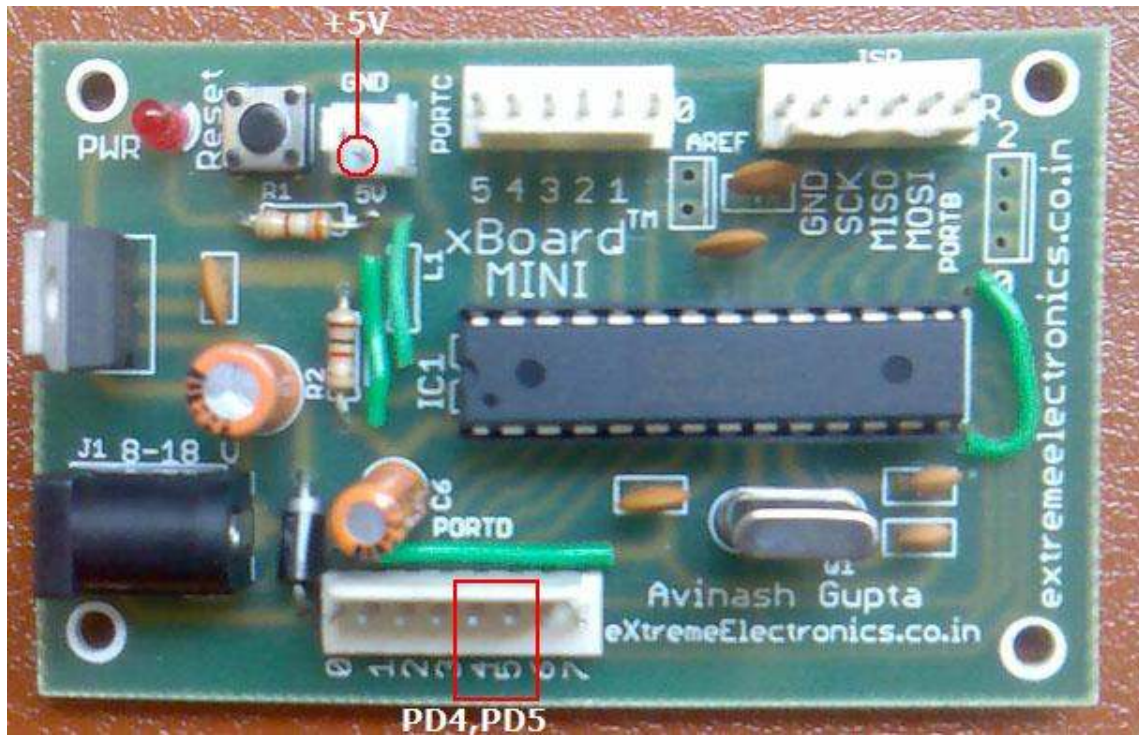| Items Required. |
|---|
| DC Motor 12V |
| L293D chip |
| Breadboard. |
| Some wires |

program into the MCU and power on the system. The motor will rotate and will change directions after some times.

L293D chip on breadboard.

A motor Connected to l293d chip.

PD4,PD5,+5V and GND terminals on xBoard-MINI

Speed Control

The speed of DC motor can also be controlled with MCU. PWM or pulse width modulation technique is used to digitally control speed of DC motors. I will show you how that is done in later tutorials after I introduce you with internal TIMERS of AVR because PWM is generated using timers.

Whats next

Next I will show you how to interface a 16x2 character LCD Modules.