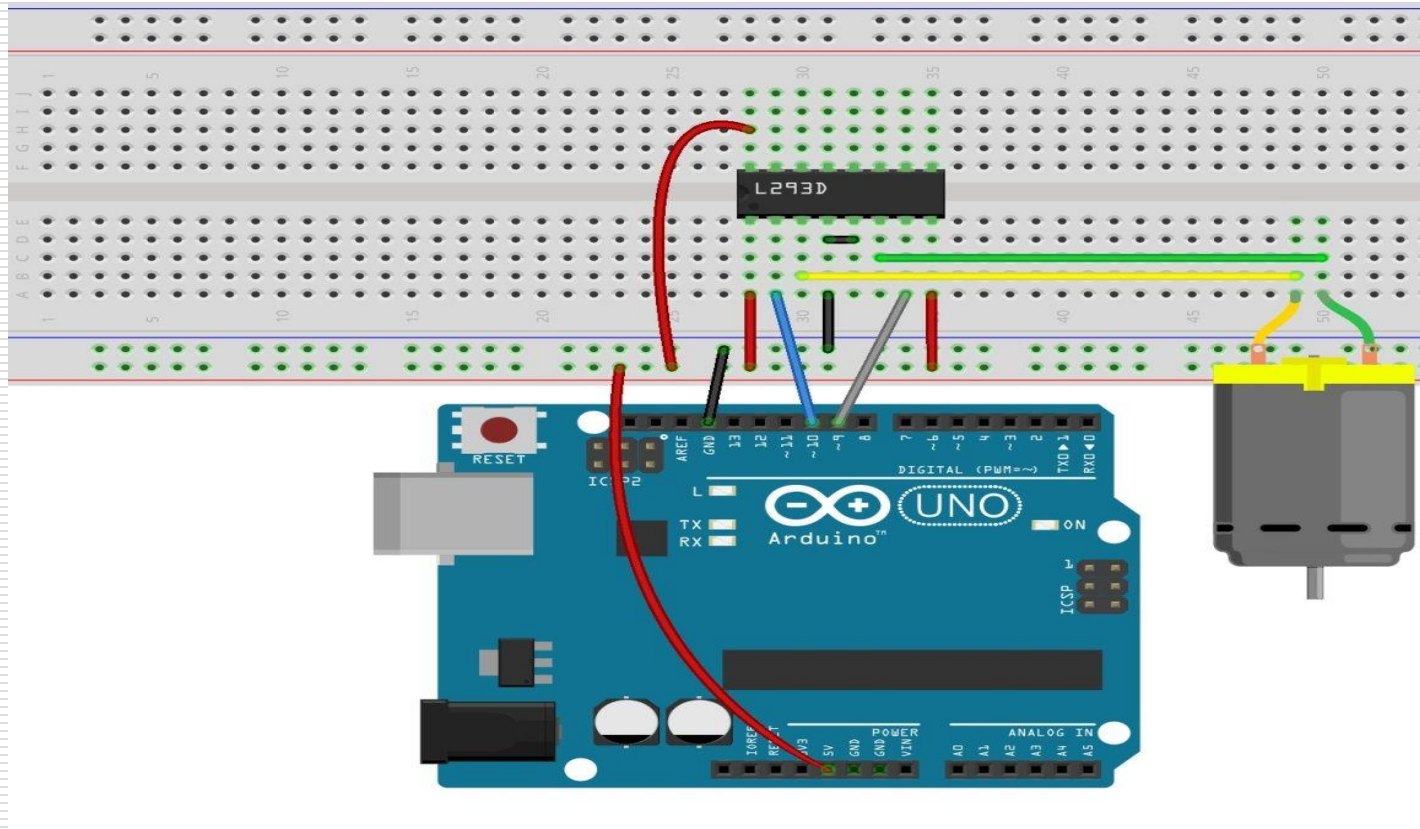# CSE423: Embedded System Summer-2020
Control a DC Motor

Todays Lecture

- *What is DC motor*

- *Working principle of DC motor*

- *How to connect a DC motor with Arduino*

- *How to control a DC motor*

DC Motor

A **DC** motor (**D**irect **C**urrent motor) is the most common type of motor. DC motors normally have just two leads, one **positive** and one **negative**. If you connect these two leads directly to a battery, the motor will rotate. If you switch the leads, the motor will rotate in the opposite direction.
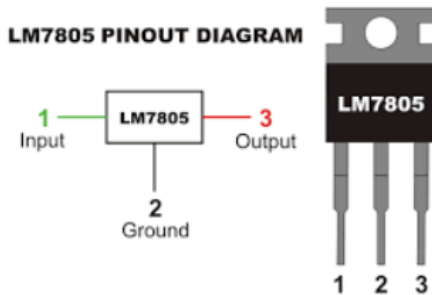
Today we will learn, how to run and control a DC Motor

Required Components
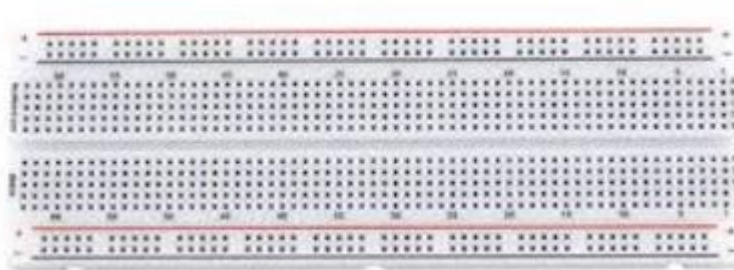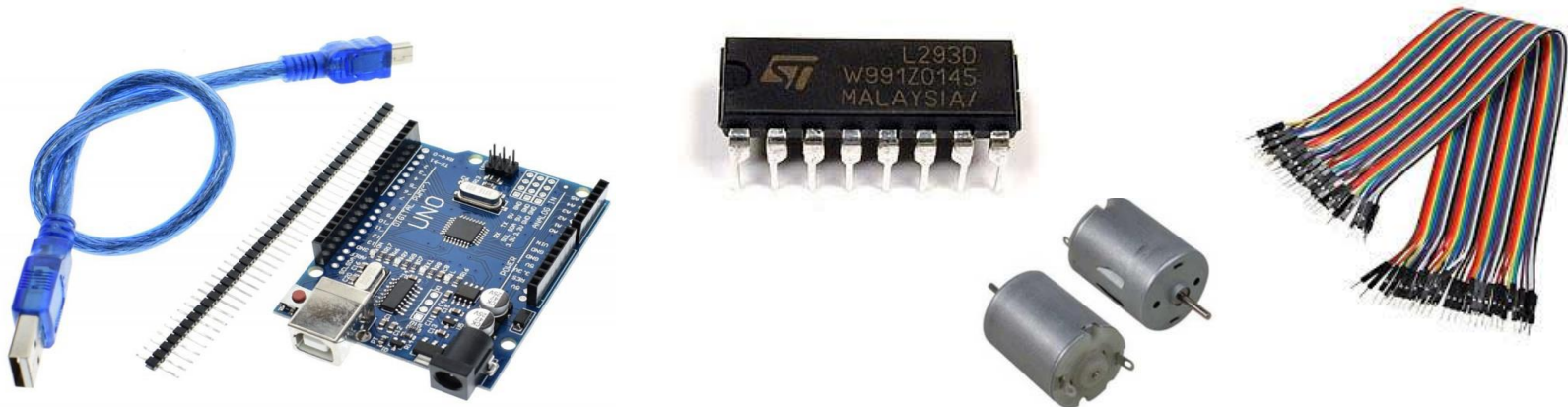
Why Driving Motors with L293D?

L293D

❑ Driving electro-motors needs a high current.

❑ In addition, spinning direction and speed are two important parameters to be controlled. These requirements can be handled by using a microcontroller (or a development board like Arduino).

❑ But Microcontrollers cannot provide enough current to run the motor and if you connect the motor to the microcontroller directly, you may damage the microcontroller. For example, Arduino UNO pins are limited to 40mA of current which is far less than the 100-200mA current necessary to control a small dc motor.
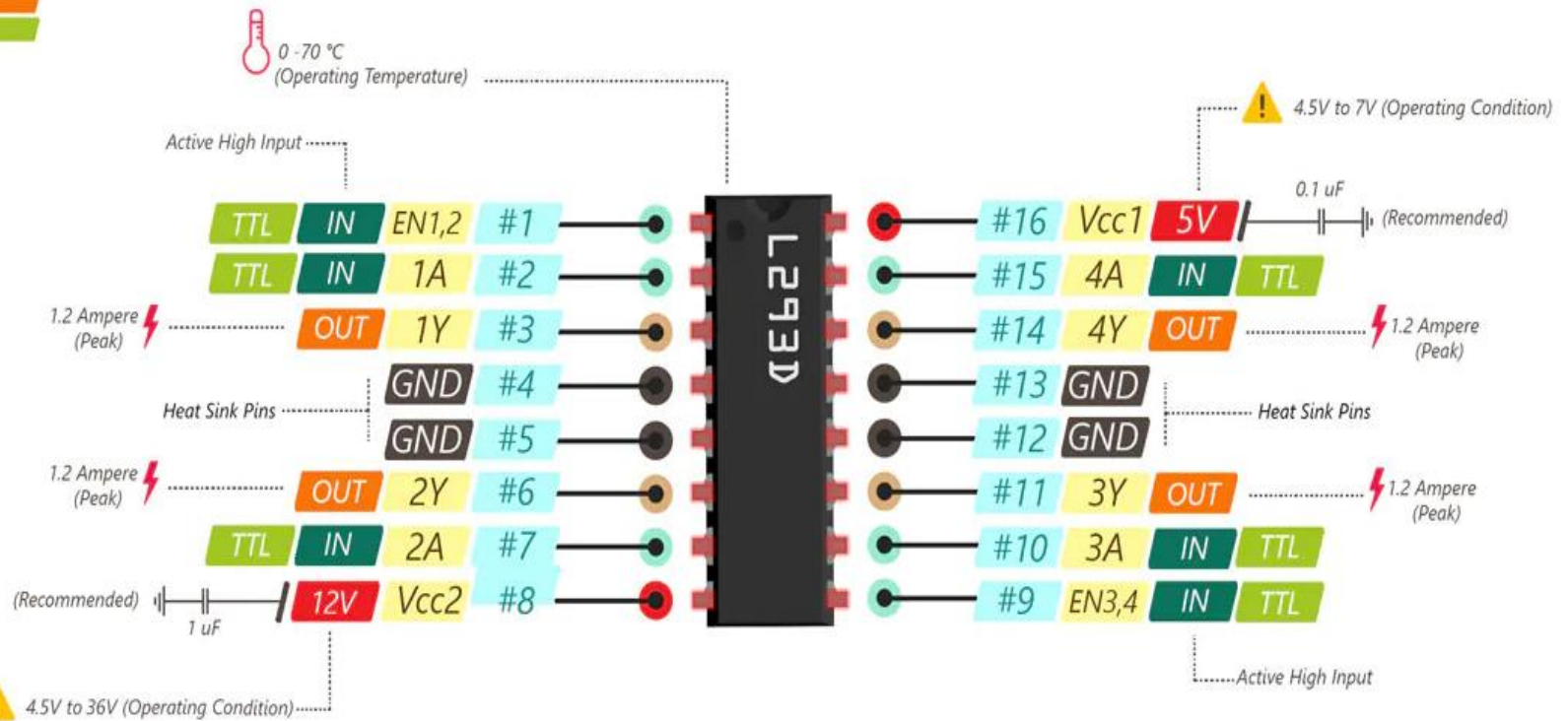
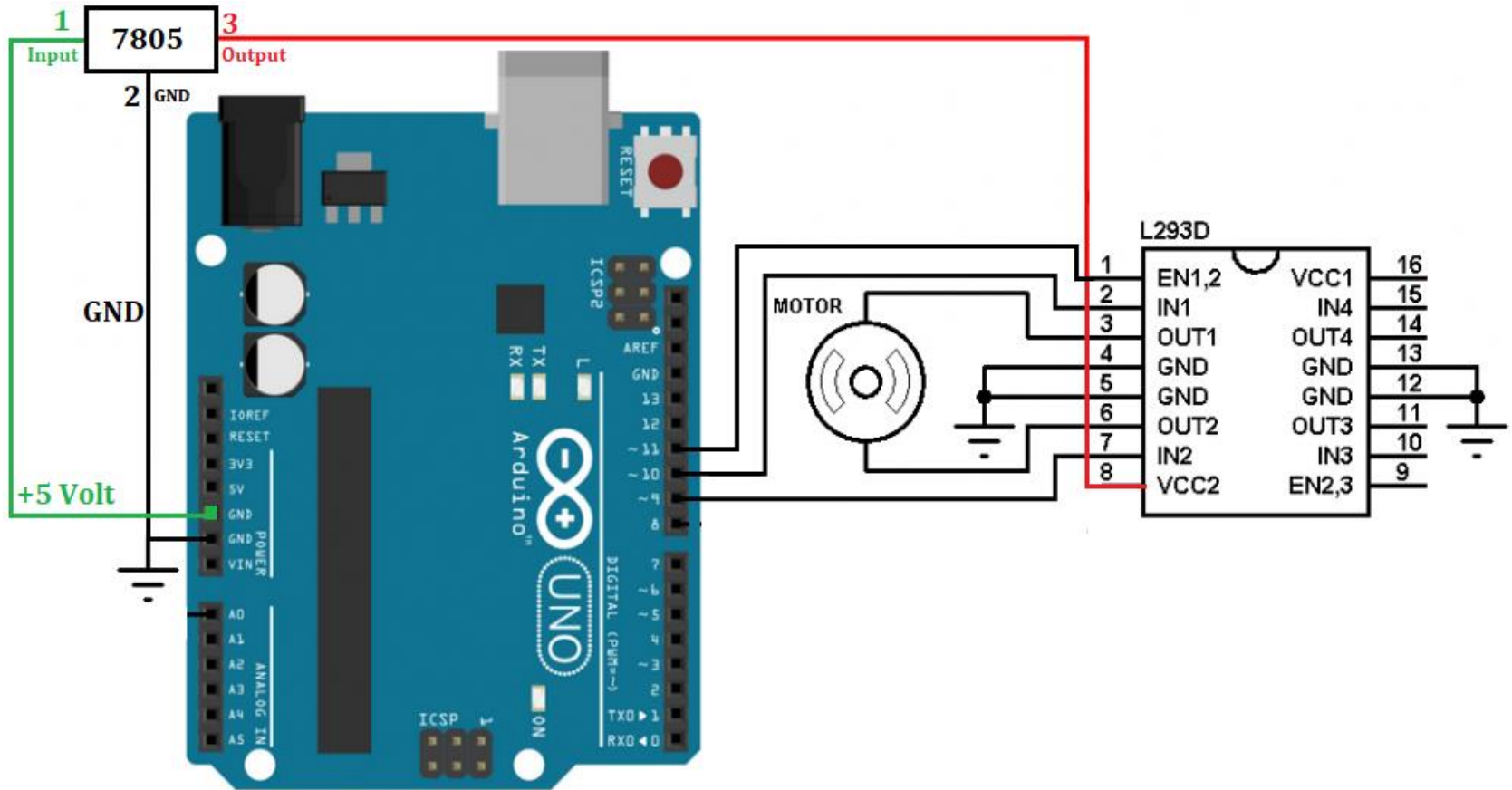L293D is one of the most popular motor drivers to run DC motors with up to 1A current load.

Pin Layout for L293D

Complete Circuit Diagram

How to connect

Pin of L293D	Connection with Arduino Pin
PIN-1 (Enable)	11
PIN-2 (Input-1)	10
PIN-3 (Ouput-1)	Motor (+ve)
PIN-4 (GND)	GND
PIN-5 (GND)	GND
PIN-6 (Output-2)	Motor (-ve)
PIN-7 (Input-2)	9
PIN-8 (Vcc-1)	+5 V (output from LM7805)

Pin of LM7805	Connection with Pin
PIN-1 (Input)	5 V (Arduino)
PIN-2 (GND)	GND (Arduino)
PIN-3 (Ouput)	PIN-8 (Vcc-1-L293D)

Code to run the motor

```
int enable1 = 11;     // Assign Pin for Enable Pin of L293D
int in1 = 10;         // Assign Pin for Input-1 of L293D
int in2 = 9;          //  Assign Pin for Input-2 of L293D

void setup()
{
pinMode(enable1, OUTPUT);
pinMode(in1, OUTPUT);
pinMode(in2, OUTPUT);
}

void loop()
{
digitalWrite(enable2, HIGH); // Must be High to run the motor
digitalWrite(in1, HIGH);
digitalWrite(in2, LOW);
}
```

Control the direction of the motor

To control the **direction** of the motor, we need to control the **Input Pins** by changing the values alternatively to rotate it clockwise or anti-clockwise.

```
int enable1 = 11;    // Assign Pin for Enable Pin of L293D
int in1 = 10;        // Assign Pin for Input-1
int in2 = 9;         //  Assign Pin for Input-2

void setup()
{
pinMode(enable1, OUTPUT);
pinMode(in1, OUTPUT);
pinMode(in2, OUTPUT);
}

void loop()
{
digitalWrite(enable2, HIGH); // Must be High to run the motor
digitalWrite(in1, HIGH/LOW);
digitalWrite(in2, LOW/HIGH);
}
```

Control the speed of the motor

To control the **speed** of the motor, we need to control the **Enable Pin** by change the syntax from "digitalWrite" to "analogWrite".

```
int enable1 = 11;    // Assign Pin for Enable Pin of L293D
int in1 = 10;        // Assign Pin for Input-1
int in2 = 9;         //  Assign Pin for Input-2

void setup()
{
pinMode(enable1, OUTPUT);
pinMode(in1, OUTPUT);
pinMode(in2, OUTPUT);
}

void loop()
{
analogWrite(enable2, analog value); //Any analog value between 0-255
digitalWrite(in1,HIGH);
digitalWrite(in2,LOW);
}
```

What About Controlling the Speed of your Home Ceiling Fan??🙂