NATIONAL INSTITUTE OF TECHNOLOGY AGARTALA

MICROPROCESSOR AND MICROCONTROLLERS LAB

ELECTRONICS AND INSTRUMENTATION ENGINEERING

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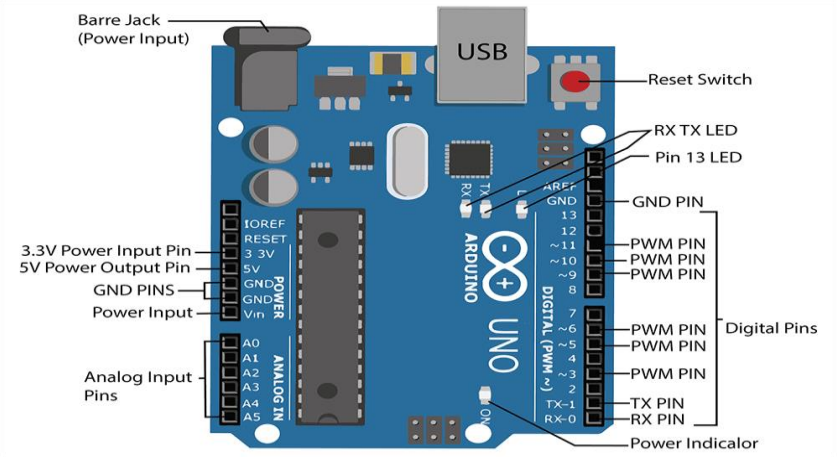
INTRODUCTION :-

DC (direct current) motor is an electrical machine which converts electrical energy into mechanical energy. It can rotate in either direction based on the polarity of the applied voltage.

It is an electronics and automation project that involves the design, construction, and programming of a system to control the speed and direction of DC motors. Controlling a DC motor using an Arduino is a common and practical application of Arduino microcontrollers. DC motors are commonly used in various applications, including robotics, industrial automation, electric vehicles, and home automation systems.

COMPONENTS:-

1. ARDUINO UNO R3:



Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst-case scenario you can replace the chip for a few dollars and start over again.

2. DC MOTOR:

A DC motor is a type of electric motor that converts electrical energy into mechanical motion. It operates on the principle of electromagnetic induction and is widely used in various applications due to its simplicity and controllability.

Basic Components of a DC Motor:

Stator: the stationary part of the motor, typically made up of a permanent magnet or field winding, which creates a magnetic field.

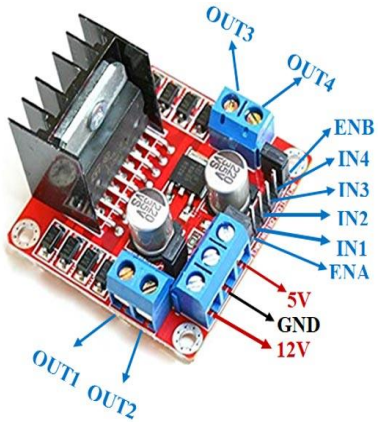
Rotor: the moving part of the motor, often a coil of wire, which interacts with the magnetic field and generates motion.

Commutator: a split ring connected to the rotor that reverses the direction of current flow through the rotor windings, allowing it to continuously rotate.

Brushes: carbon or graphite contacts that maintain electrical contact with the commutator, delivering current to the rotor windings.

When voltage is applied to the motor, current flows through the rotor windings. The interaction between the current-carrying rotor and the magnetic field created by the stator generates a force, known as the Lorentz force, causing the rotor to rotate. As the rotor spins, the commutator and brushes ensure that the direction of the current in the rotor windings reverses at the appropriate time, keeping the rotor in continuous motion.

3. L298 MOTOR DRIVER:



The L298 is a popular dual H-bridge motor driver integrated circuit (IC) that is widely used for controlling DC motors and stepper motors in robotics, automation, and various electronic projects. It allows to control the direction and speed of two DC motors independently or control a single stepper motor. The L298 motor driver is capable of handling relatively high voltage and current levels. It is often used with motor voltage supplies in the range of 5V to 46V and can handle peak currents of up to 2A per channel. It accepts control signals from a microcontroller, such as an Arduino. it provides a convenient solution for controlling motors.

TECHNICALSPECIFICATIONS OF L298 MOTOR DRIVER

Motor output voltage	5V – 35V
Motor output voltage (Recommended)	7V – 12V
Logic input voltage	5V – 7V
Continuous current per channel	2A
Max Power Dissipation	25W

4. POTENTIOMETER:

A potentiometer used to vary the electrical resistance in a circuit manually. It's a type of variable resistor with three terminals and a knob or slider for adjustment. Potentiometers serve various purposes in electronics, including volume control in audio equipment, brightness adjustment in displays, and user input in control systems. The key feature of a 10k potentiometer is its resistance value of 10,000 ohms. This means that when we measure the resistance between the two outer terminals (1 and 3), will typically read approximately 10,000 ohms, though there may be slight variations in manufacturing. As turn the knob or slide the wiper of the 10k potentiometer, the position of the wiper along the resistive element changes. It is used for calibration and fine-tuning circuits to achieve desired performance.

5. JUMPER WIRES:

This cable is an electrical wire or group of them in a cable with a connector or pins at each end, which is normally for interconnecting the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

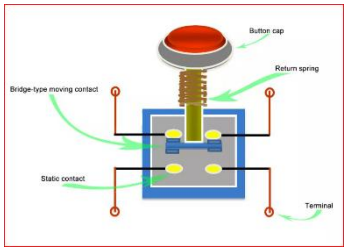
6. BATTERY:

Batteries are often used as a portable and independent power source where mobility or off-grid operation is essential. They provide the necessary voltage and current for the project's components. Batteries can act as backup power sources in case of mains power failures. This is crucial for applications that require uninterrupted operation, such as emergency lighting or critical systems. To control dc motor, we used 12v Battery.

7. BREADBOARD:

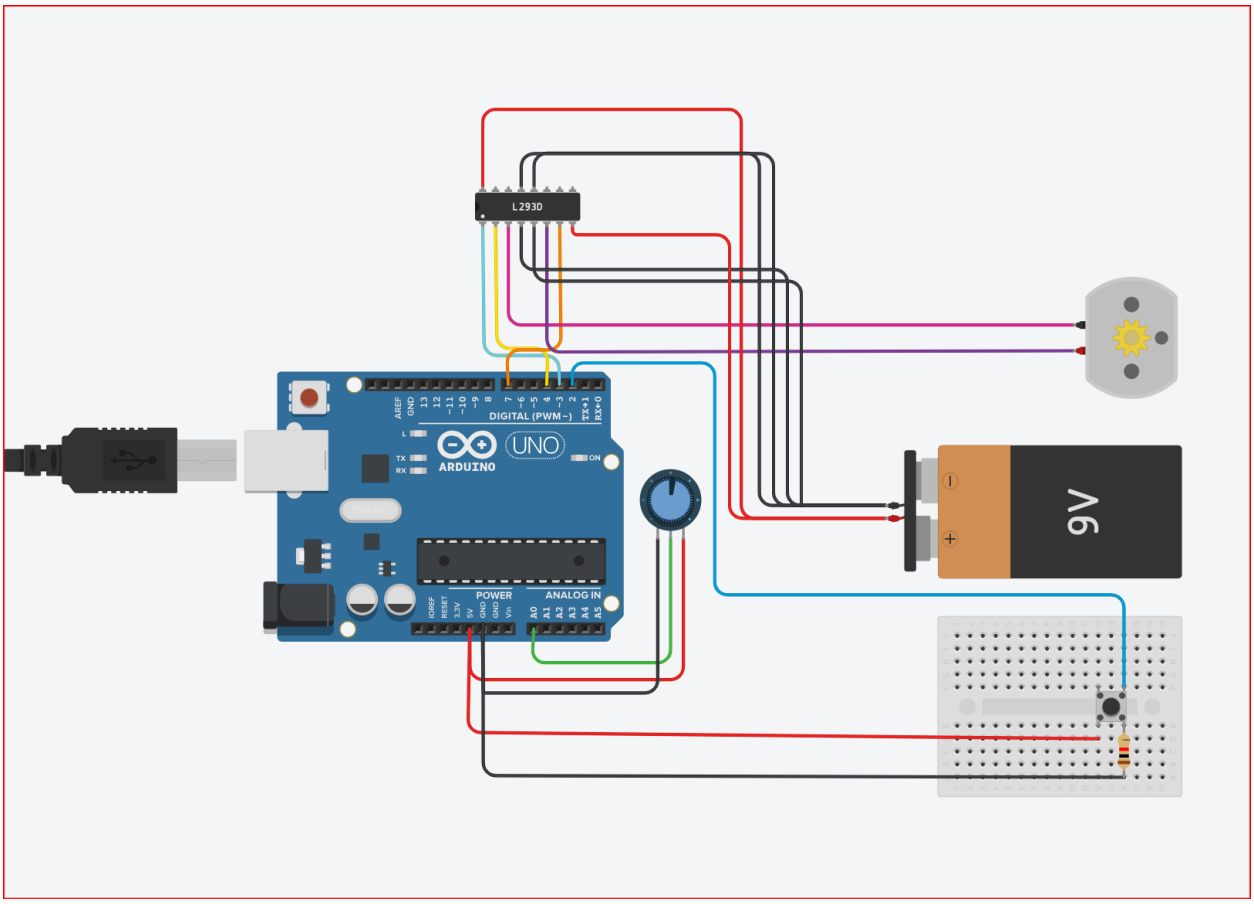
A breadboard is an excellent platform for prototyping and testing electronic circuits before finalizing the design or soldering components onto a permanent PCB (Printed Circuit Board).we can use a breadboard to create and modify circuits rapidly, making it easy to experiment with different component placements and connections.

8. Push Button:



Pressure is placed on the button or actuator, resulting in the depression of the internal spring and contacts and the touching of stable contacts at the bottom of the switch.

Circuit diagram:



Arduino code:

```
#define ENA 3
#define In1 4
#define In2 7
#define button 2
```

```
int sensorvalue=0;
int x=0;
bool buttonState=LOW;
int a=1;
void setup() {
  Serial.begin(9600);
  pinMode(A0,INPUT);
  pinMode(ENA,OUTPUT);
  pinMode(In1,OUTPUT);
  pinMode(In2,OUTPUT);
  pinMode(button,INPUT);
}

void loop() {
  sensorvalue=analogRead(A0);
  buttonState=digitalRead(button);
  x=sensorvalue/4;
  if(buttonState==HIGH){
    Serial.println("State Changed");
    if(a==0){
      a=1;
    }
    else{
      a=0;
    }
    delay(3000);
  }
  if (a==1) {
    digitalWrite(In1,HIGH);
    digitalWrite(In2,LOW);
    analogWrite(ENA,x);
    Serial.print("Clockwise ");

  }
  else{
    digitalWrite(In1,LOW);
    digitalWrite(In2,HIGH);
    analogWrite(ENA,x);
    Serial.print("Anti Clockwise ");
  }
  Serial.println(x);
  delay(2000);
}
```

Working:

- Setup: The Arduino is programmed to control a DC motor using a motor driver module (e.g., L298N or L293D) to manage the motor's speed and direction.
- Direction Control: The code configures two digital output pins (IN1 and IN2) on the motor driver module to control the direction of the motor. By setting these pins to HIGH and LOW or LOW and HIGH, the motor can be made to rotate in either direction.
- Speed Control: The enable Pin is configured as a PWM (Pulse Width Modulation) output. By varying the PWM value between 0 and 255, the speed of the motor can be controlled. Higher values correspond to higher speeds.
- Motor Operation: The code runs the motor in one direction for a specified duration (in this example, 2 seconds), then stops the motor by setting the PWM value to 0. It then reverses the direction of the motor, changes the speed, and runs it for another 2 seconds.
- Potentiometer control: a potentiometer allows you to control and adjust voltage or resistance in a circuit by changing the position of a wiper along a resistive element. The voltage output is determined by the division of resistance and is a versatile component used in many electronic devices for user control or as part of feedback and sensing systems.
- Loop: The loop continues to run, repeatedly reversing the motor direction and changing the speed, creating a cycle of motor operation.
