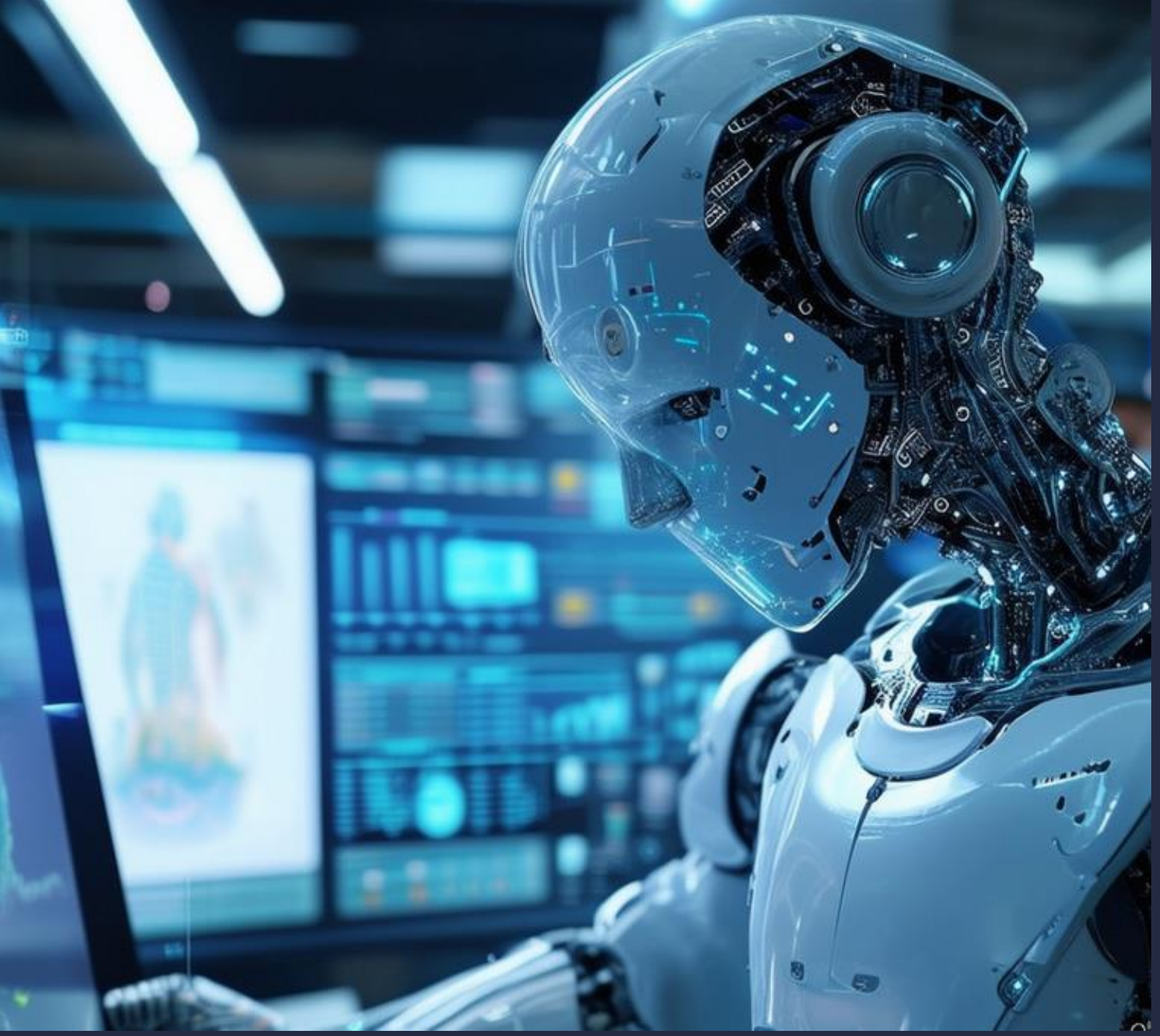


Basic Robotics Workshop

Organised by **KURC**

Course Outline

Electronics basics

Arduino Basics

Bluetooth and Communication

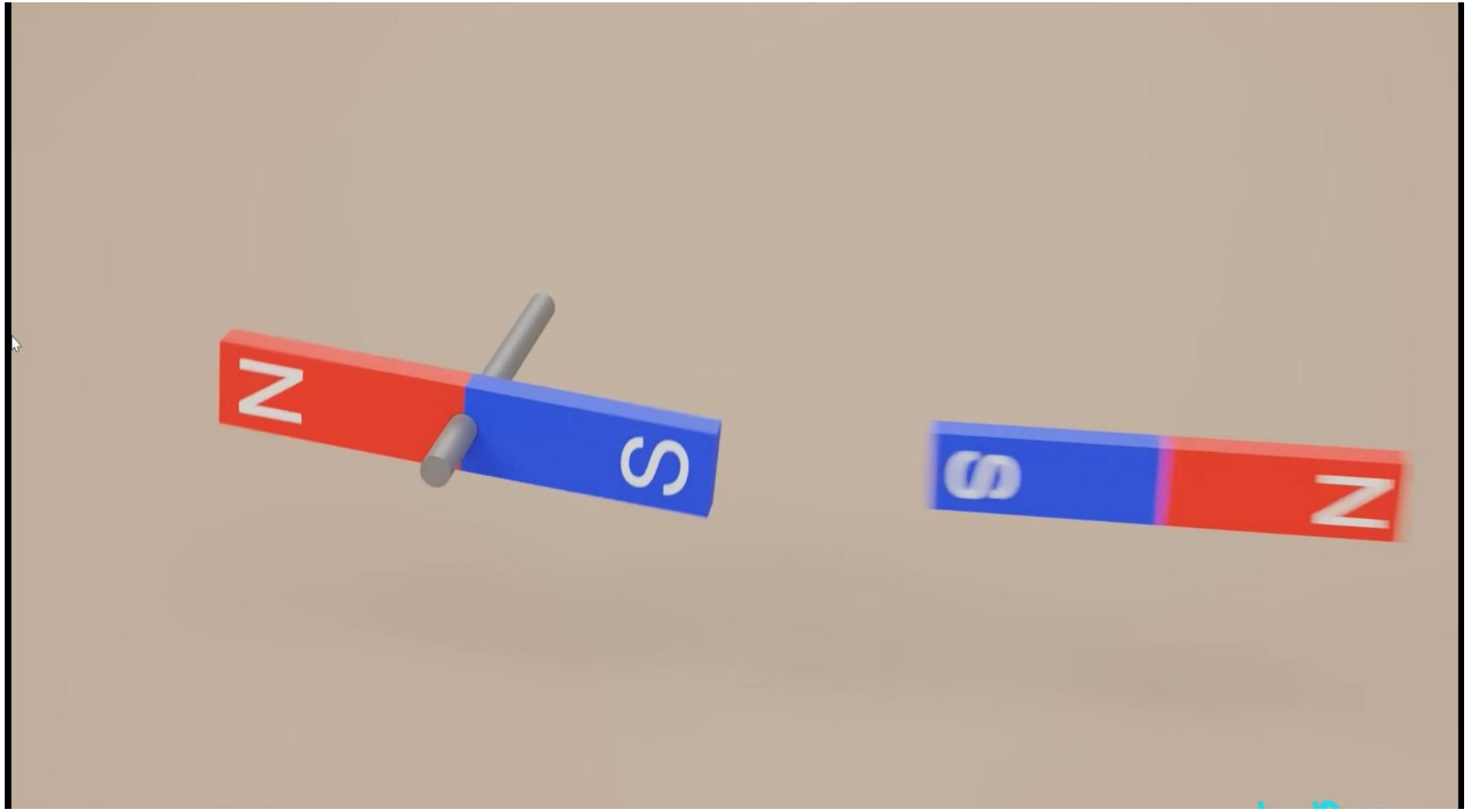
Motors and Actuators

Robotics Project

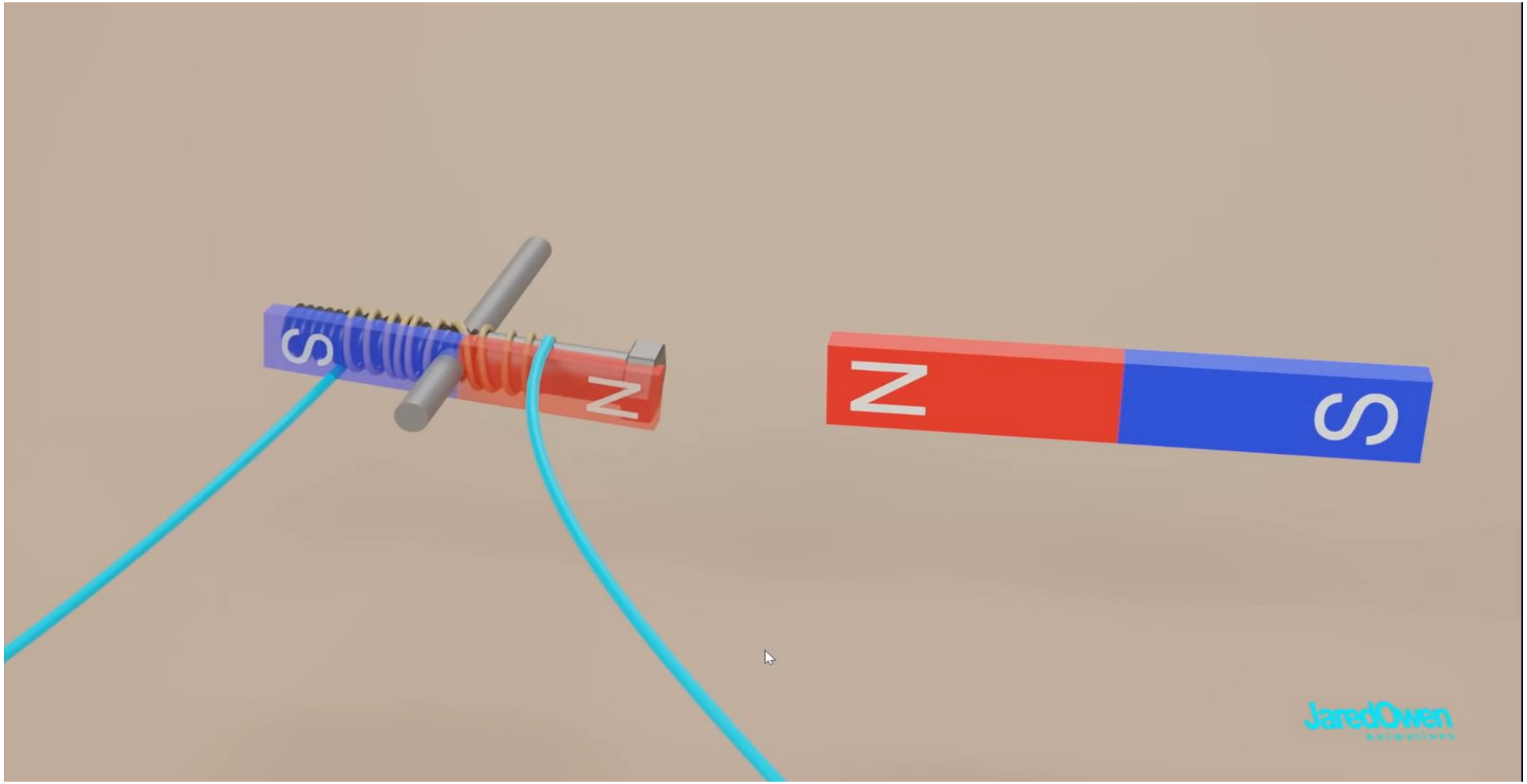
Motors

- Motors are devices that convert electrical energy into mechanical motion.
- They play a crucial role in robotics for movement, control, and actuation.
- You can control a DC motor to an Arduino and control its speed with PWM using a motor driver.

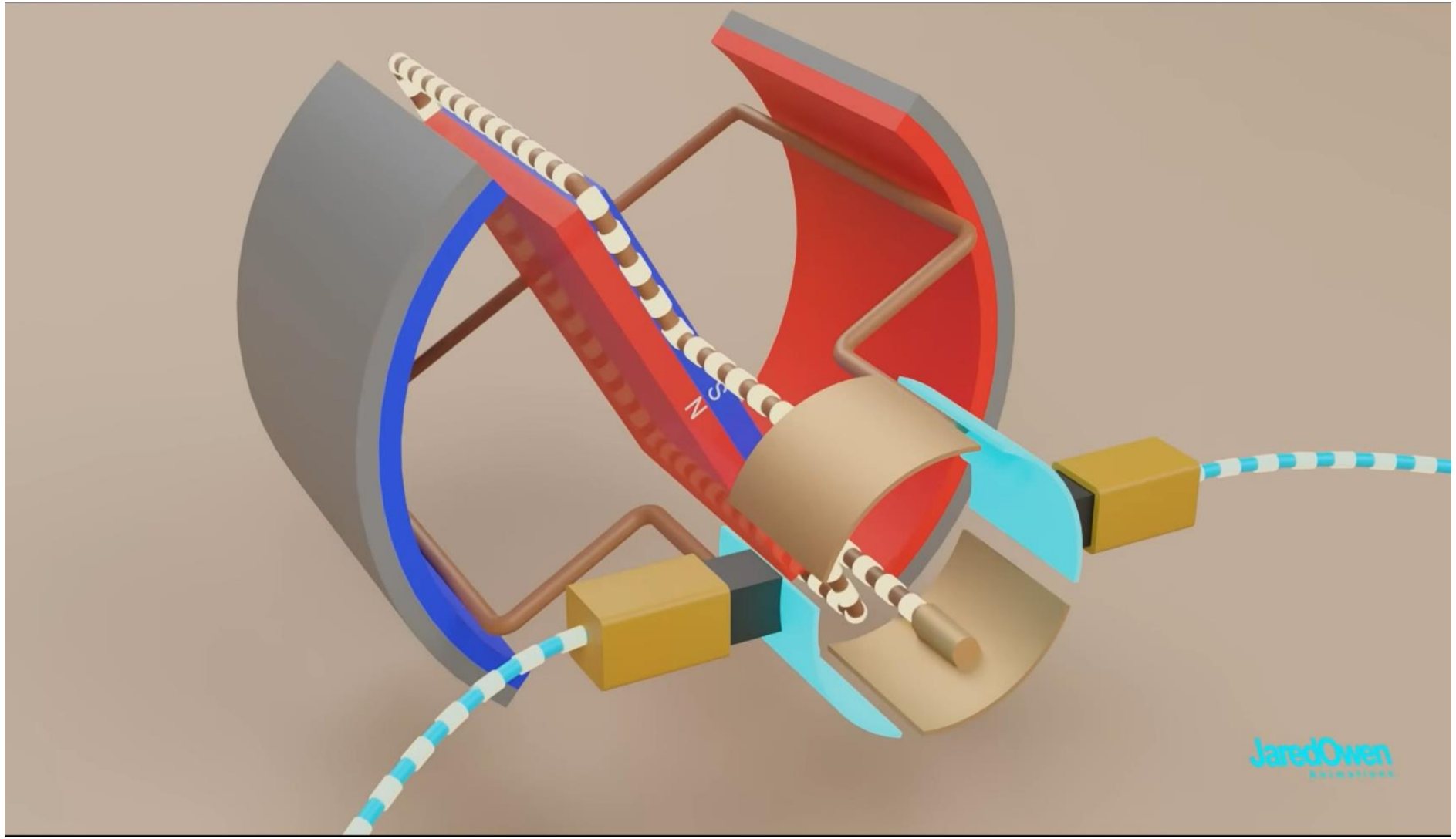
Fundamental Principle



Modification



Proper DC Motor



Servo Motors

- Servo motors are rotary or linear actuators that provide precise control of angular or linear position, velocity, and acceleration.
- They consist of a motor, a feedback sensor (usually a potentiometer), and a control circuit.

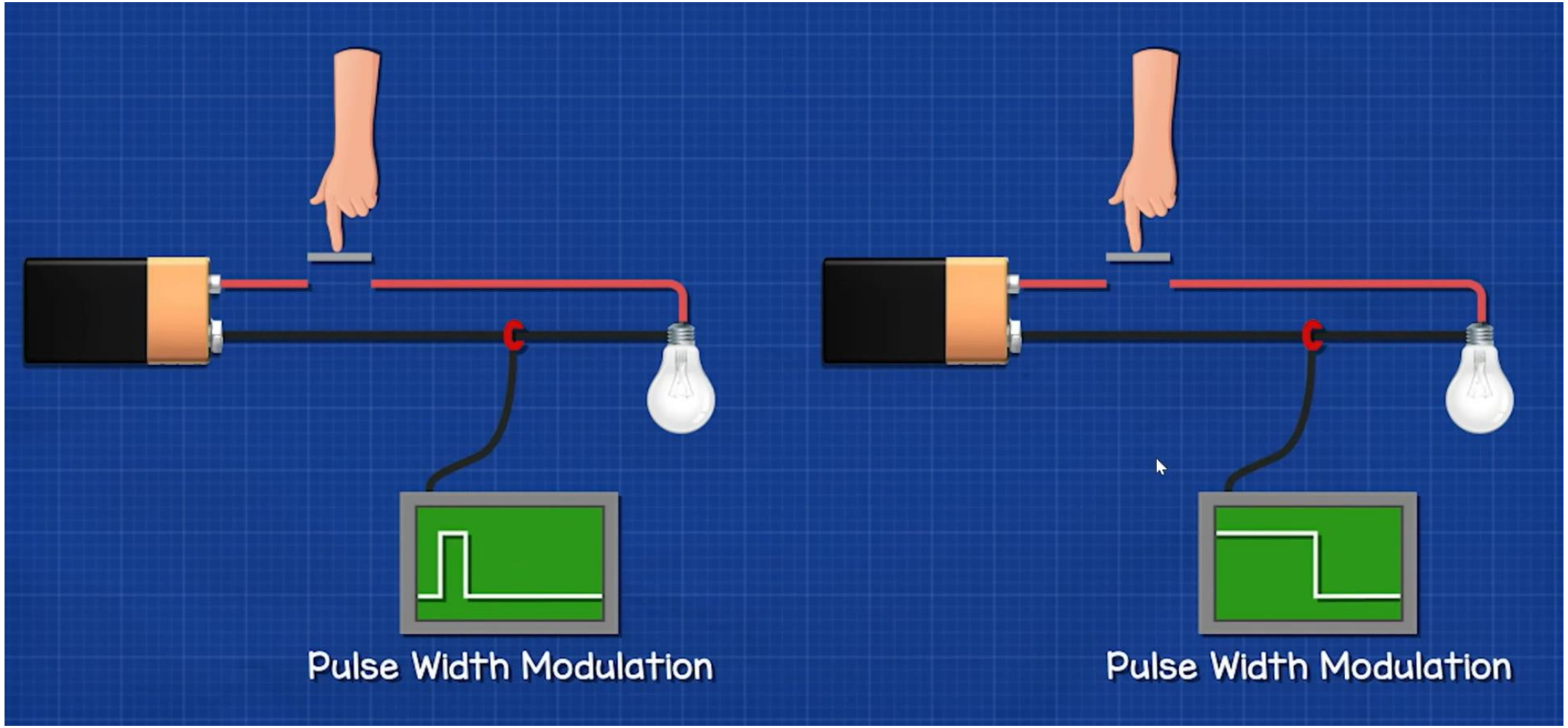
How they work

- The servo motor is controlled by Pulse Width Modulation (PWM) signals sent to its control wire.
- The PWM signal contains:
  - Pulse Width: Determines the position.
  - Frequency: Often 50 Hz (20 ms cycle).

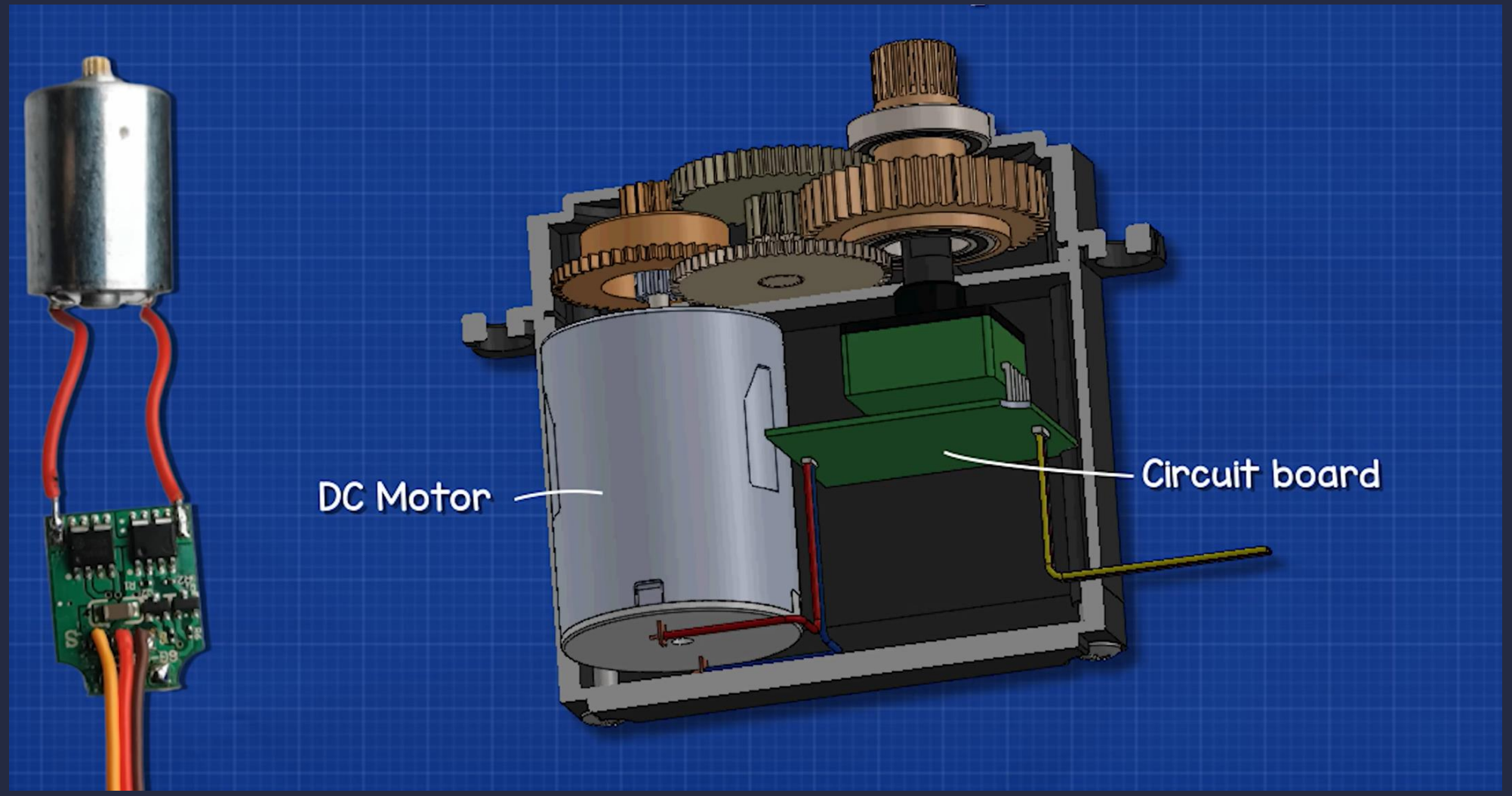
PWM

- Most microcontrollers (like Arduino, ESP32) don't have true analog outputs, only digital pins that can output HIGH (1) or LOW (0).
- PWM allows you to simulate an analog voltage using digital pins by controlling the ratio of HIGH to LOW signals.

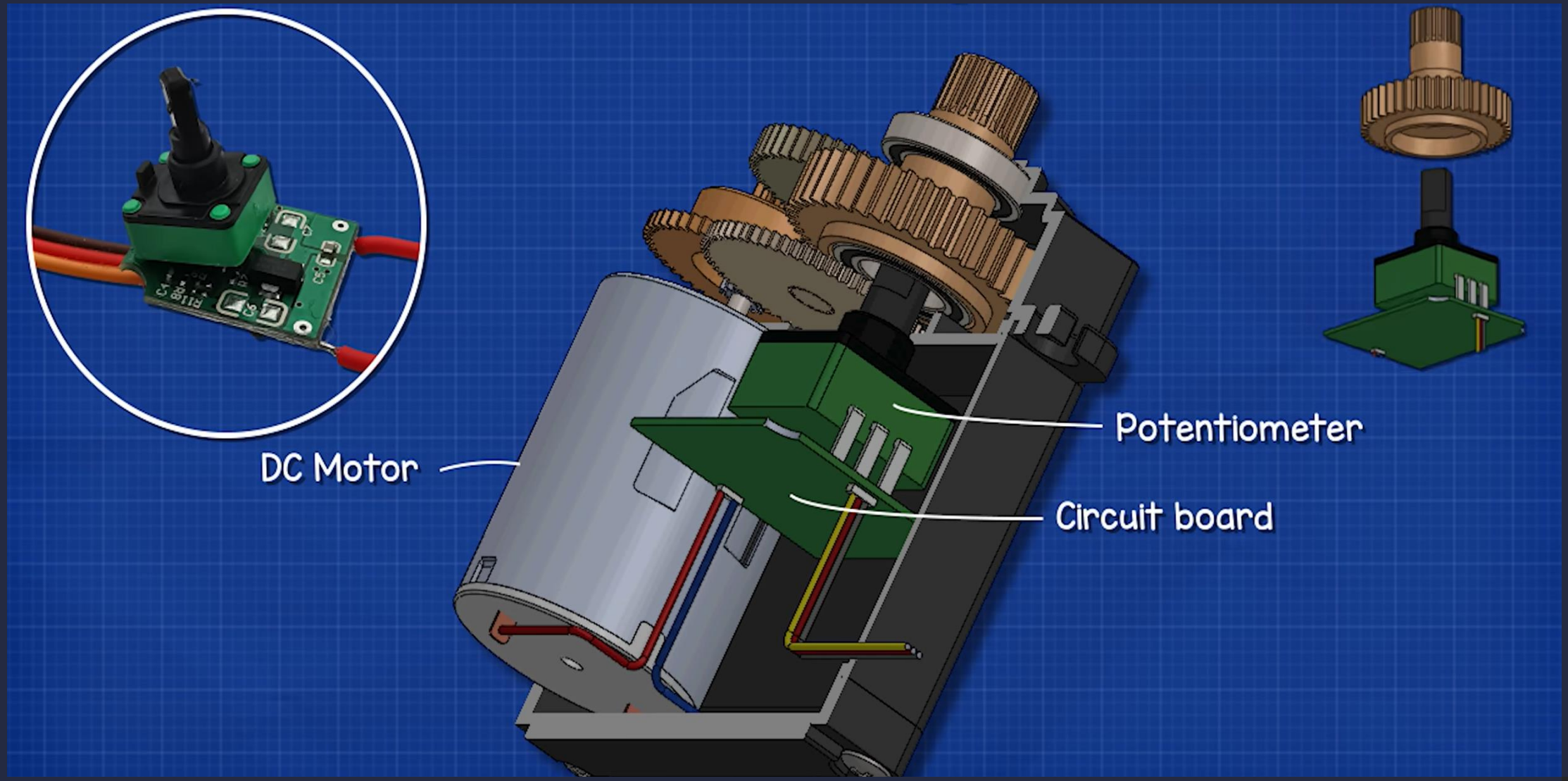
PWM Demonstration



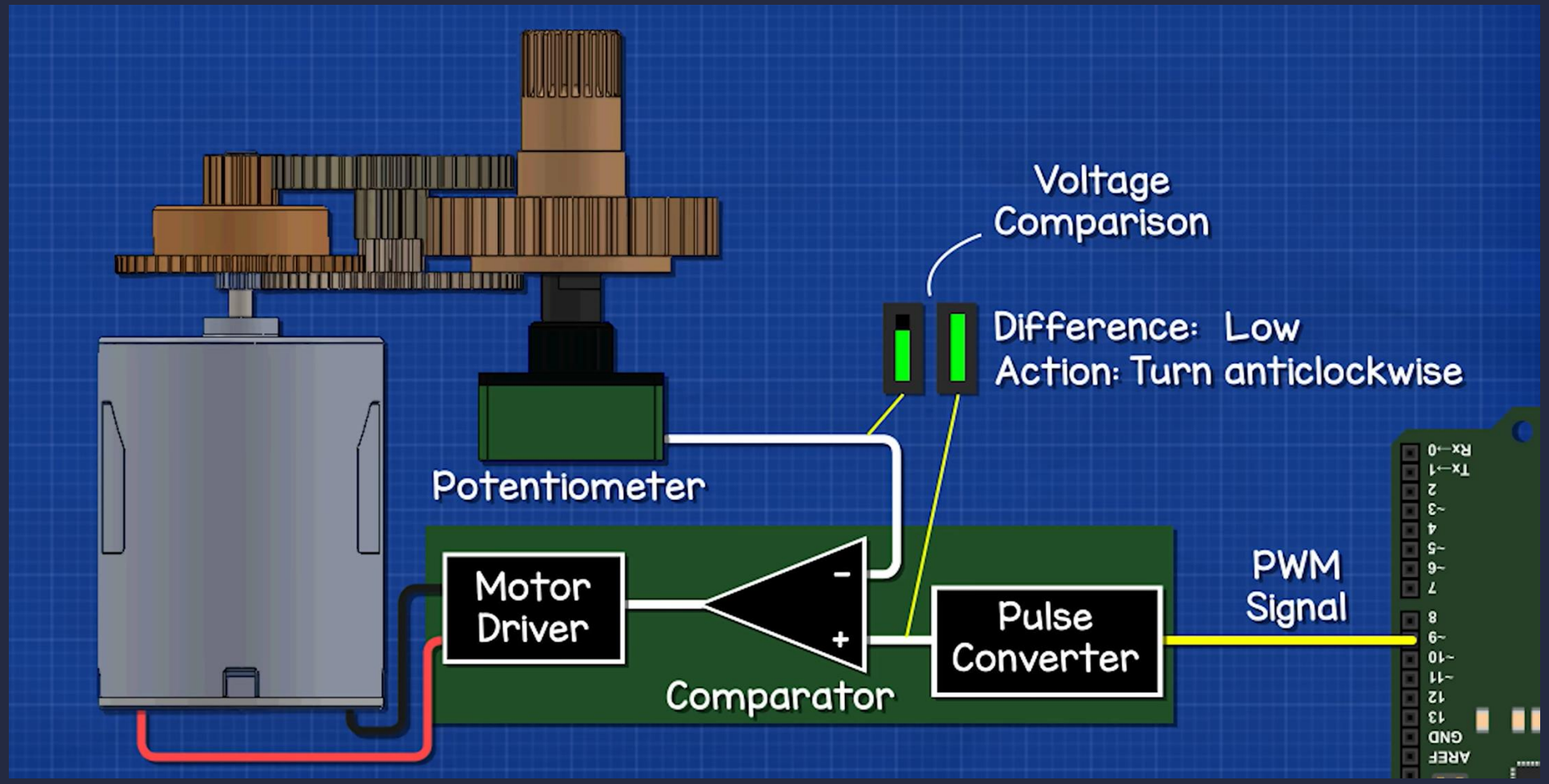
Its components



Position Control

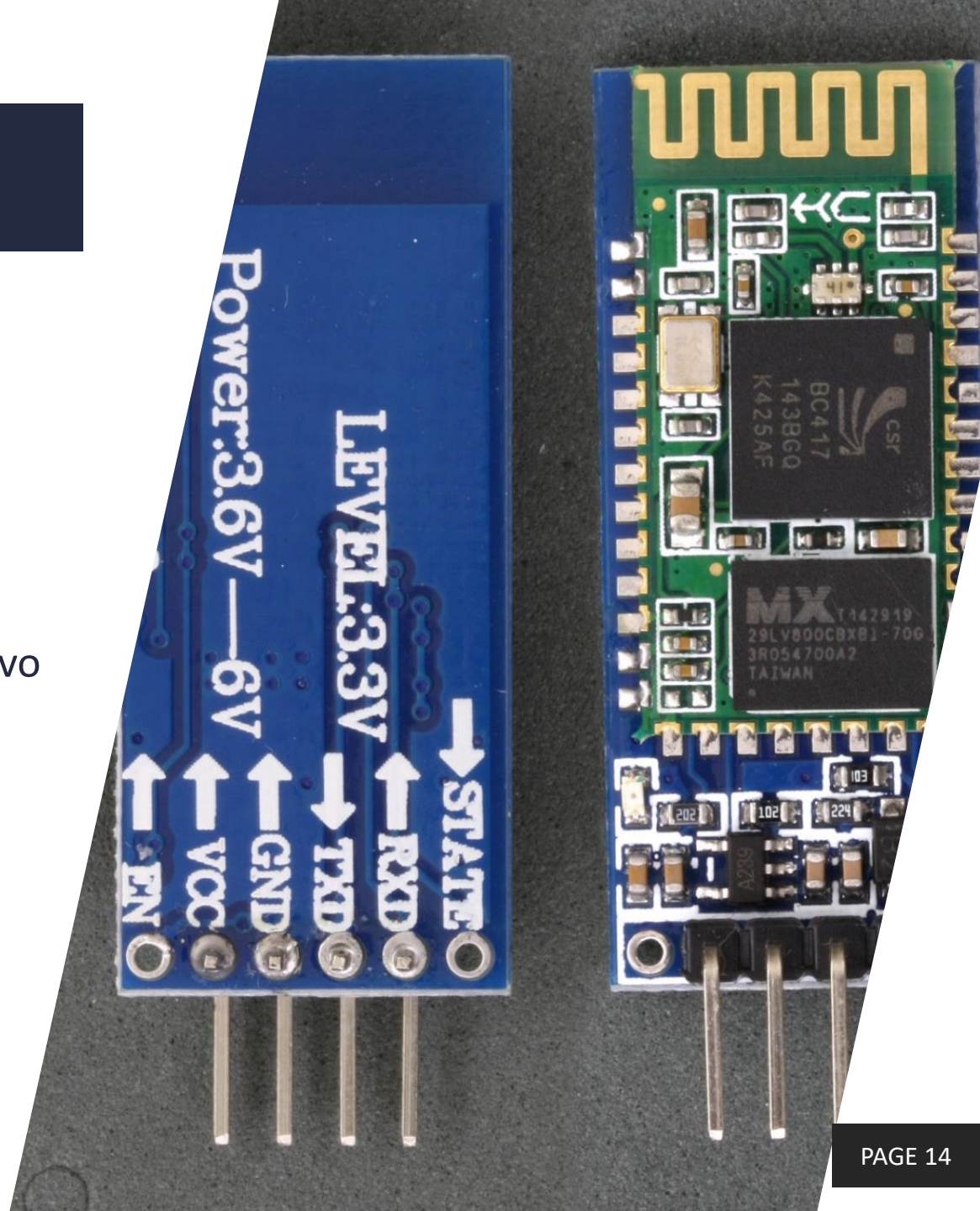


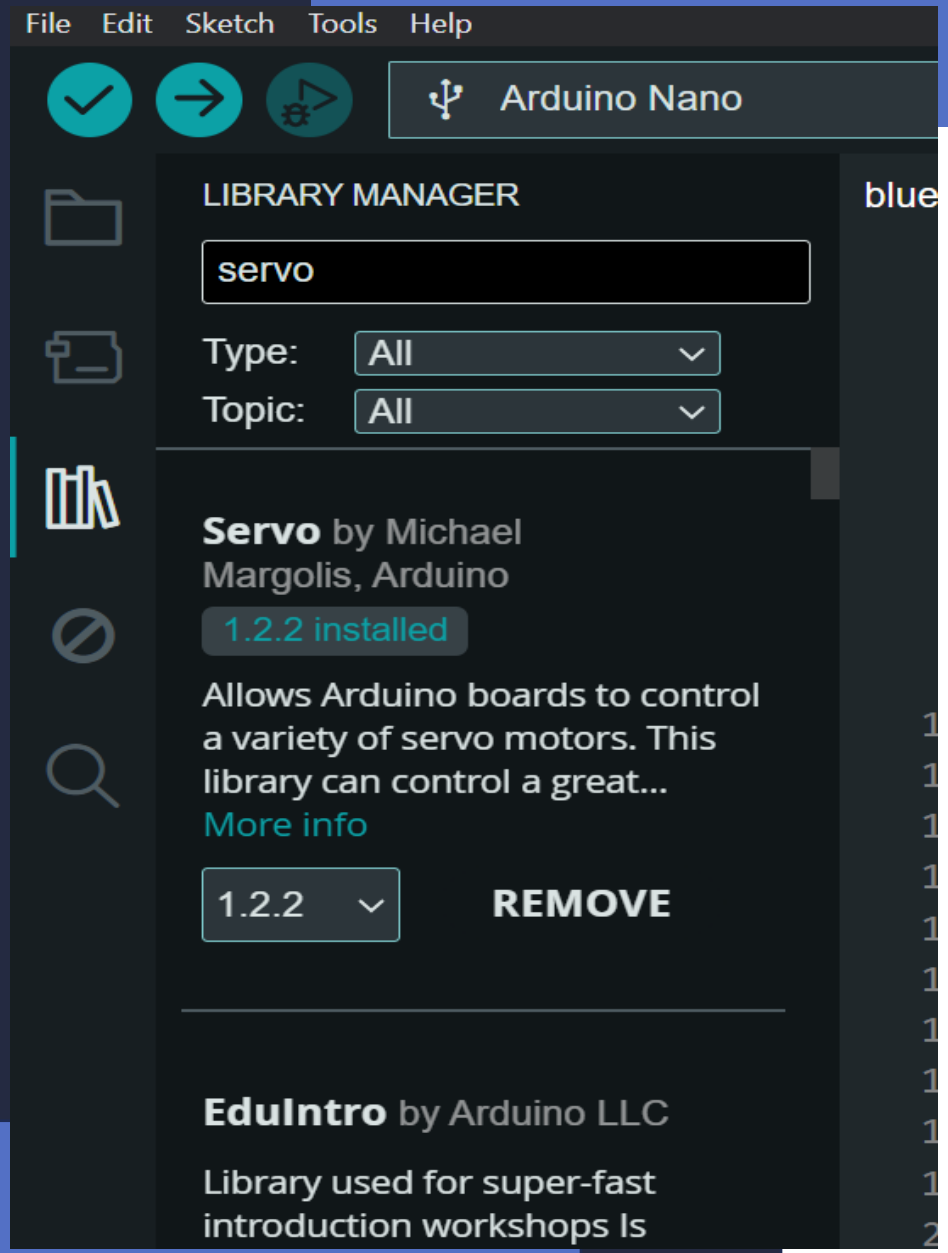
Internal Circuit



Task 1: Servo

- Your first task today will be to test the servos with simple sweep function provided.
- You will then proceed to control the servos with potentiometer.
- Data received via the potetntimeter is sent to the servo and rotated.
- Find the code at https://github.com/kurc2014/Basic_robotics_2025





Setting up Library

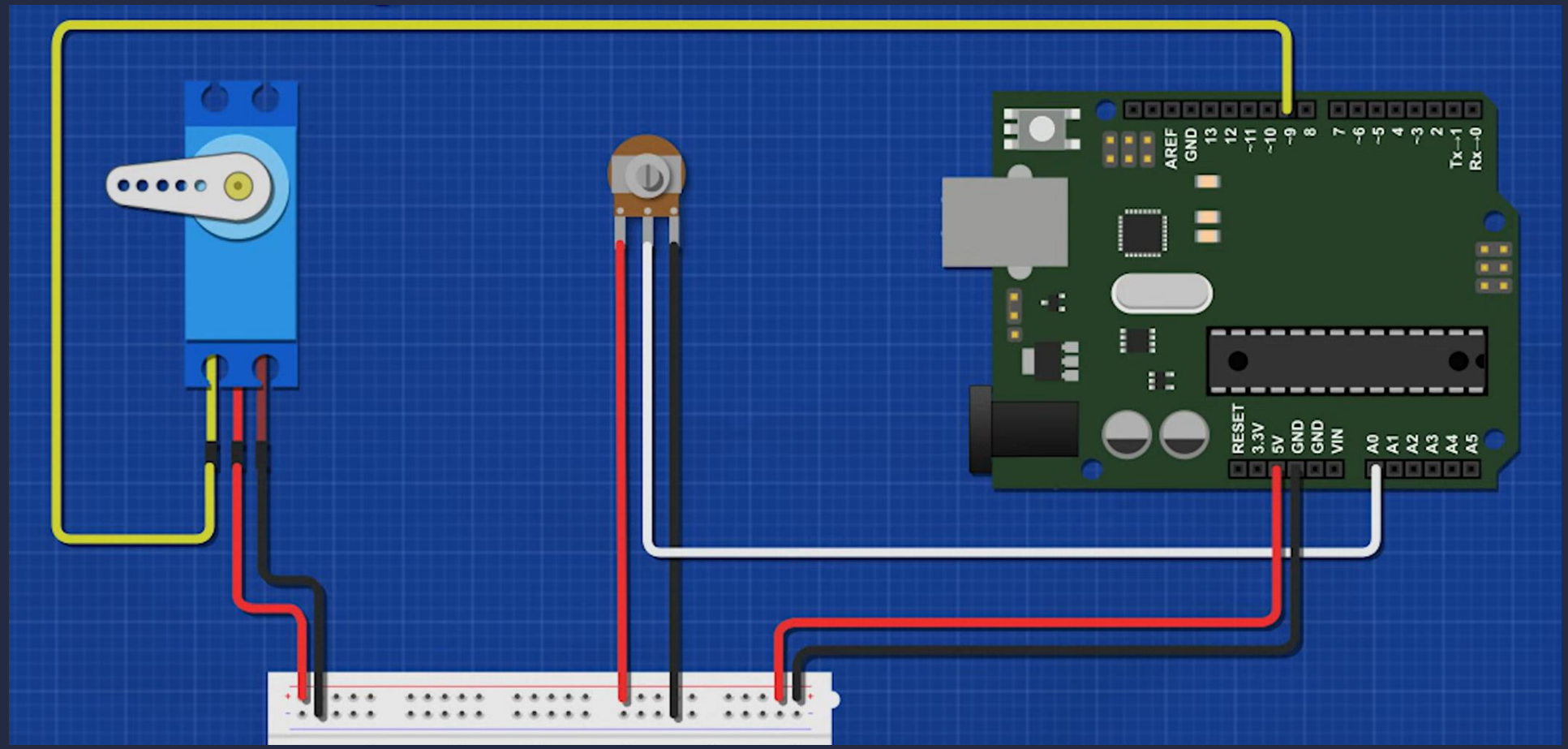
- First you will need to download the servo library.
- For this go to your sidebar and click on the library section.
- After that, you will need to Upload the code.

```
#include <Servo.h>
Servo Servo1;
int servoPin = 9;
int potPin = A0;

void setup() {
    Servo1.attach(servoPin);
}

void loop() {
    int reading = analogRead(potPin);
    int angle = map(reading, 0, 1023, 0, 180);
    Servo1.write(angle);
}
```

Control the Servo

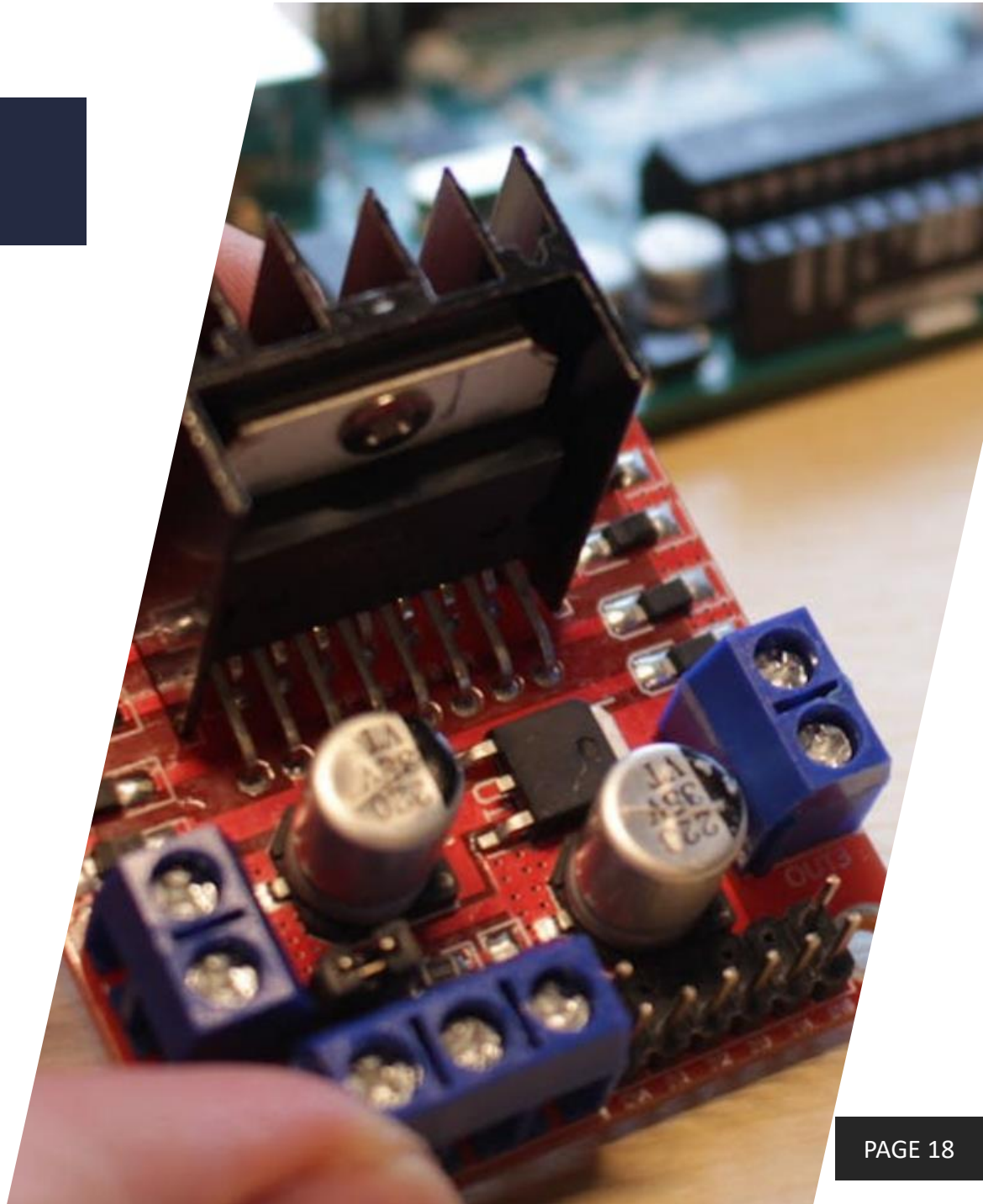
- Read Potentiometer Input
  - analogRead(potPin);
  - Reads the potentiometer's voltage (0-1023).
- Map Input to Servo
  - Anglemap(reading, 0, 1023, 0, 180);
  - Converts the potentiometer reading to an angle (0°-180°).
- Move the Servo
  - Servo1.write(angle);
  - Commands the servo to rotate to the calculated angle.

Circuit Diagram



Motor Driver

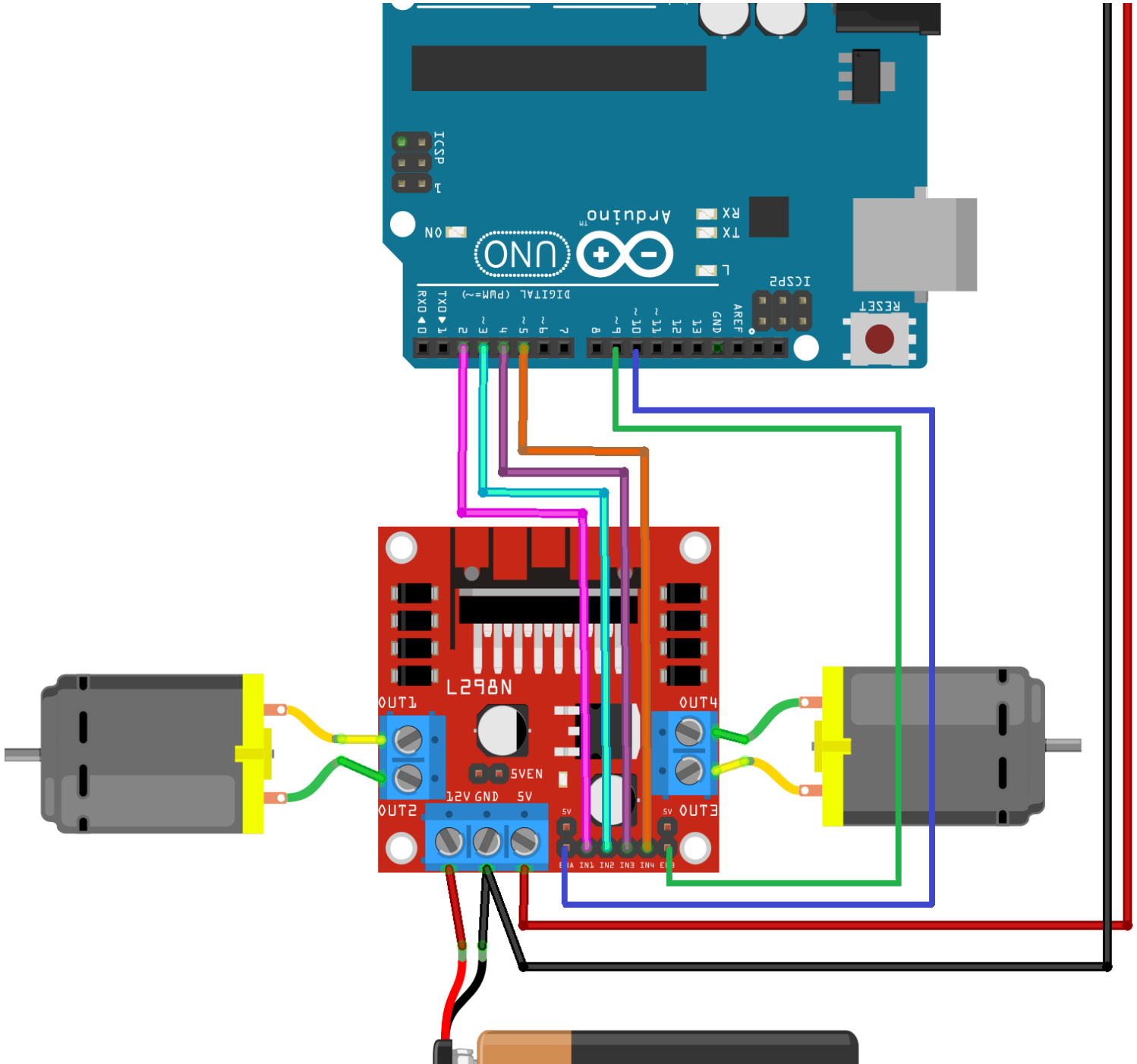
- The L298N is a dual H-bridge motor driver module used to control the speed and direction of two DC motors or a stepper motor.
- **Motor Control Pins:**
  - **IN1, IN2:** Control Motor A direction.
  - **IN3, IN4:** Control Motor B direction.
- **Enable Pins:**
  - **ENA:** Speed control for Motor A (PWM).
  - **ENB:** Speed control for Motor B (PWM).



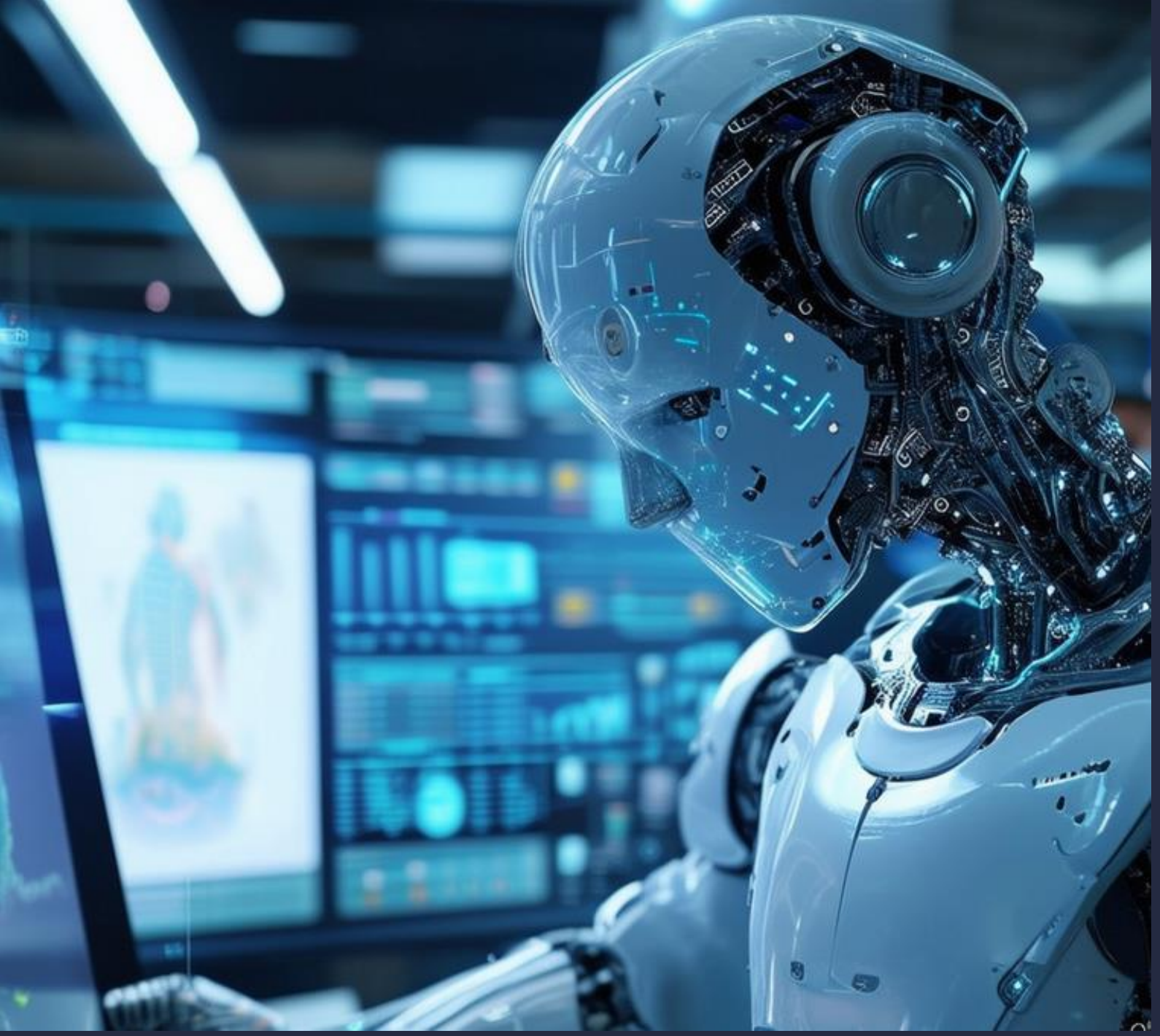
```
void loop() {
  // put your main code here, to run repeatedly:

  //Controlling speed (0 = off and 255 = max speed):
  analogWrite(9, 100); //ENA pin
  analogWrite(10, 200); //ENB pin

  //Controlling spin direction of motors:
  digitalWrite(motor1pin1, HIGH);
  digitalWrite(motor1pin2, LOW);

  digitalWrite(motor2pin1, HIGH);
  digitalWrite(motor2pin2, LOW);
  delay(1000);

  digitalWrite(motor1pin1, LOW);
  digitalWrite(motor1pin2, HIGH);
```

Control the Servo

- Controlling Speed
- analogWrite(9, 100);
- analogWrite(10, 200);
- ENA (pin 9) and ENB (pin 10) pins are controlled with PWM to set the speed.
- 100 and 200 represent the speed values (0 = off, 255 = full speed).
- The other pins are used for direction.



Circuit Diagram for L298N



End of Day 3

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