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School Program 2023-2024

Orientation Session



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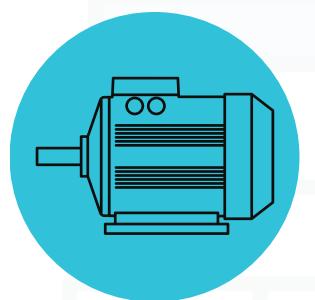
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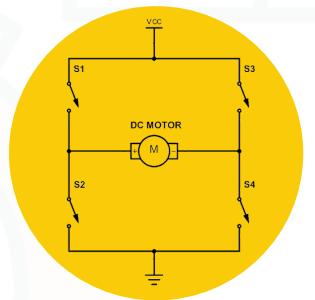
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Lesson Content



Motor



Motor Driver



Moving wheels



Robot Movement

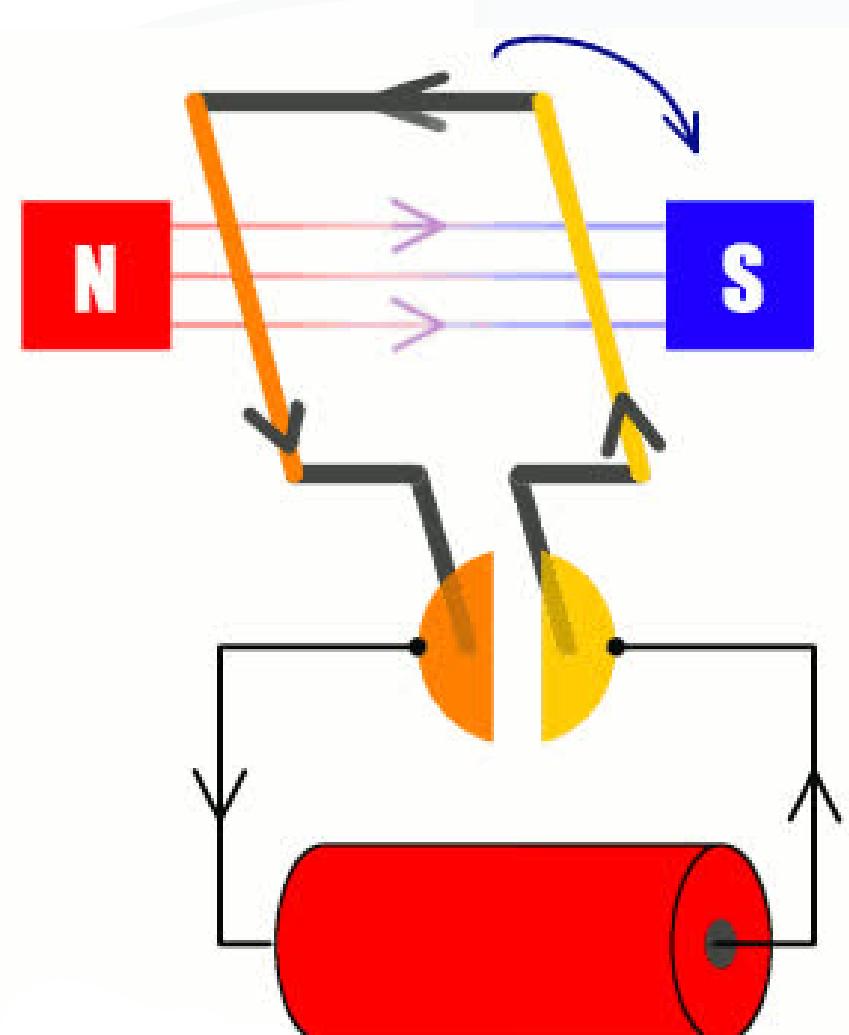
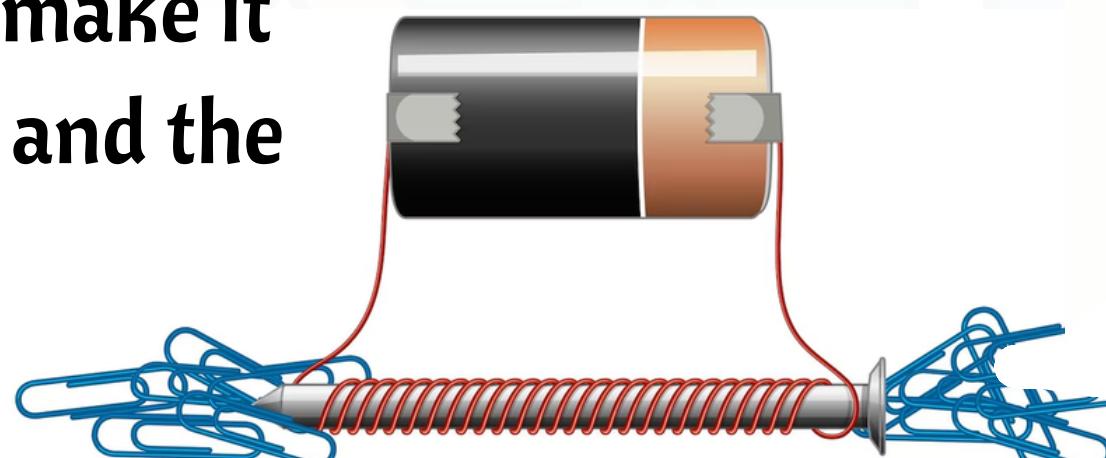
Motor

What is a motor?

It is a device that converts electrical, chemical, or nuclear energy into mechanical energy.

How does an electric motor work?

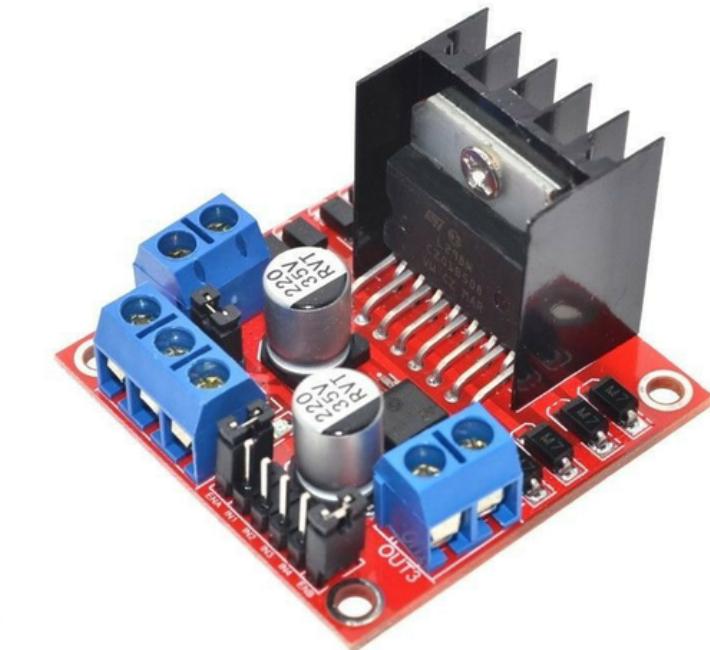
An electric circuit produces a magnetic field. So putting the circuit between 2 magnets will make it rotate due to repulsion between the circuit and the magnets.



Motor Driver

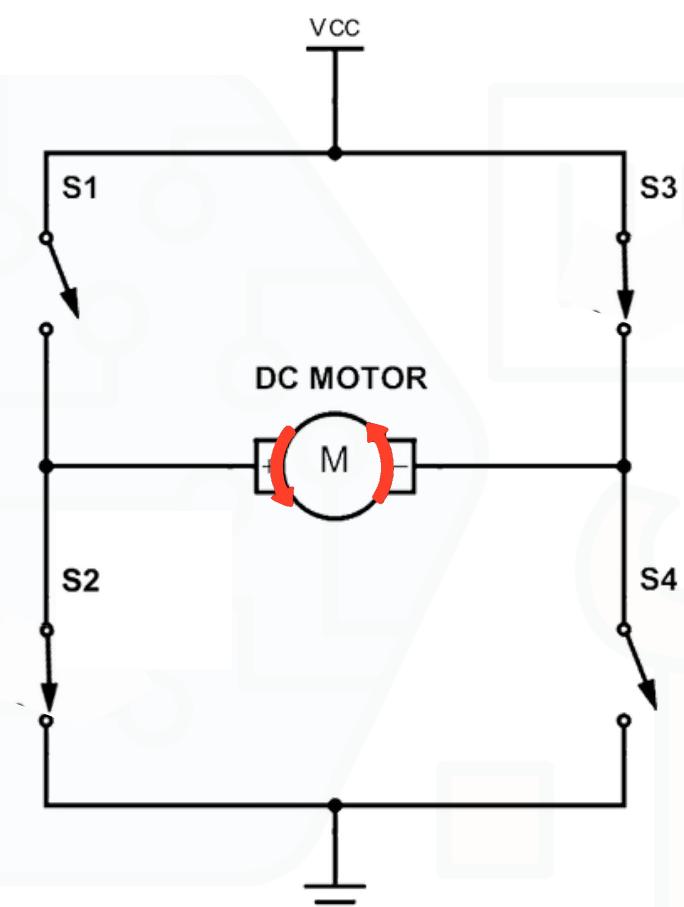
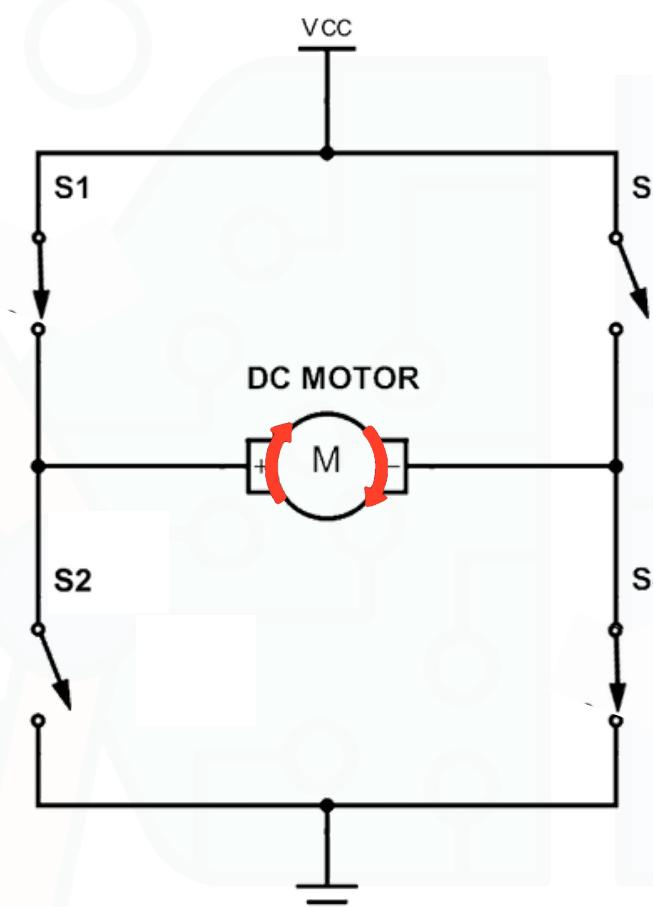
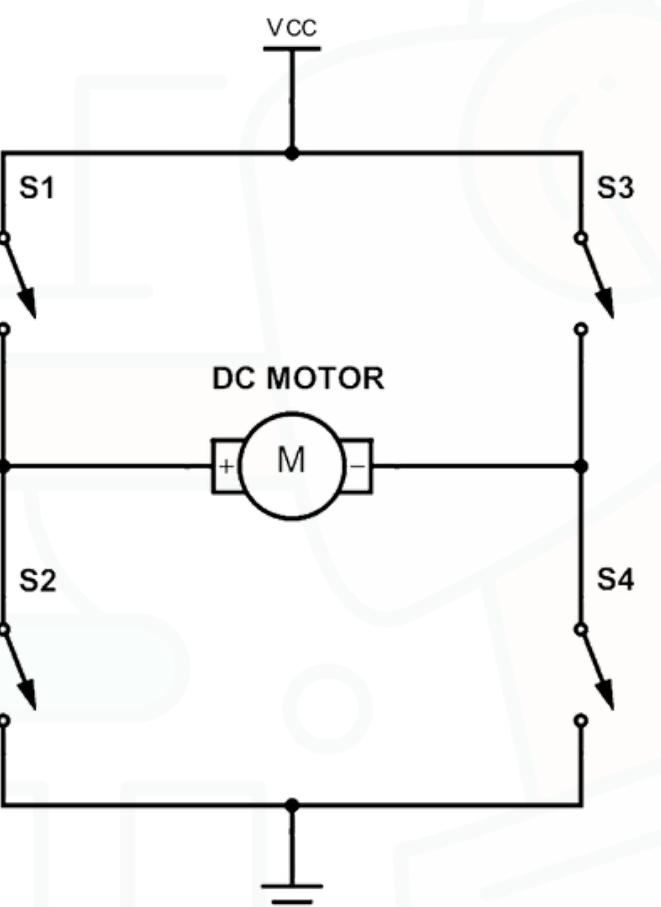
Motor driver

It is a device that controls motor's movement (direction & speed) depending on its inputs (direction of current).

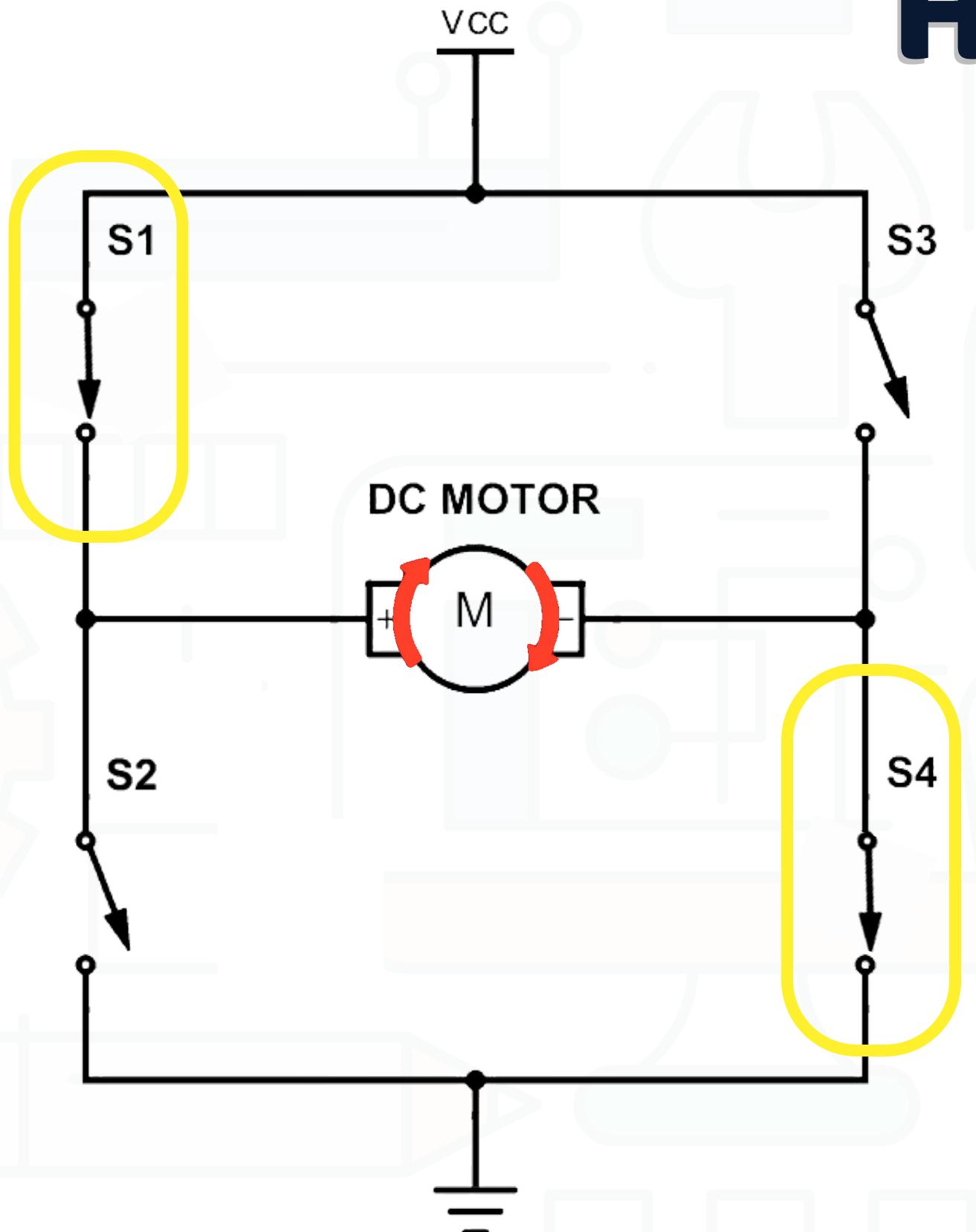


H bridge circuit

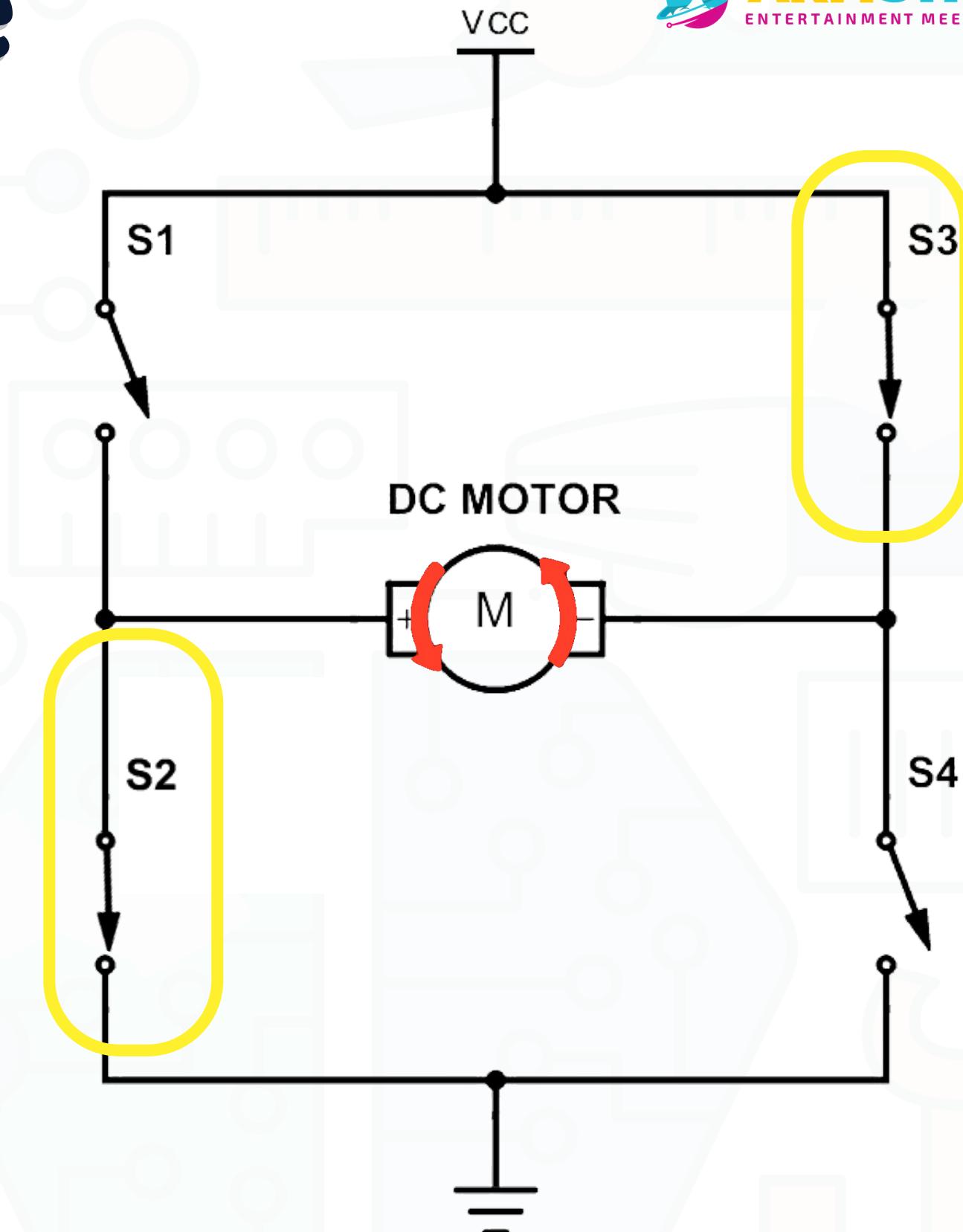
The principle of motor Driver depends on The H bridge circuit.



H bridge



Input 1



Input 2

Move 1st Wheel

Move the front right wheel forward and backward.

First we should know the connection of the driver and its pins.

Pins:

- Enable -> D10
- Input 1 -> A1(D15)
- Input2 -> A2(D16)



Move 1st Wheel

Step 1: Enabling the motor

```
void setup() {  
    pinMode(10, OUTPUT); //PWM pin  
    digitalWrite(10, HIGH); //set the PWM HIGH for now  
}
```

Enable pin

Move 1st Wheel

Step 2: Moving the wheel forwards

```
void setup() {  
    pinMode(10, OUTPUT); //PWM pin  
    digitalWrite(10, HIGH); //set the PWM HIGH for now  
    pinMode(A1, OUTPUT); //front right motor pin 1  
    pinMode(A2, OUTPUT); //front right motor pin 2  
}
```

Input1 pin
Input2 pin

```
void loop() {  
    //forward  
    digitalWrite(A1, HIGH);  
    digitalWrite(A2, LOW);  
    delay(3000);
```

Move 1st Wheel

Step 3: Moving the wheel Backwards

```
void setup() {  
    pinMode(10, OUTPUT); //PWM pin  
    digitalWrite(10, HIGH); //set the PWM HIGH for now  
    pinMode(A1, OUTPUT); //front right motor pin 1  
    pinMode(A2, OUTPUT); //front right motor pin 2  
}
```

Input1 pin
Input2 pin

```
//backward  
digitalWrite(A1, LOW);  
digitalWrite(A2, HIGH);  
delay(3000);
```

Reversed Output

Move 1st Wheel

Step 4: Adding stop

```
void loop() {  
    //forward  
    digitalWrite(A1, HIGH);  
    digitalWrite(A2, LOW);  
    delay(3000);  
  
    //stop  
    digitalWrite(A1, LOW);  
    digitalWrite(A2, LOW);  
    delay(100);  
}
```

```
//backward  
digitalWrite(A1, LOW);  
digitalWrite(A2, HIGH);  
delay(3000);  
  
//stop  
digitalWrite(A1, LOW);  
digitalWrite(A2, LOW);  
delay(100);  
}
```

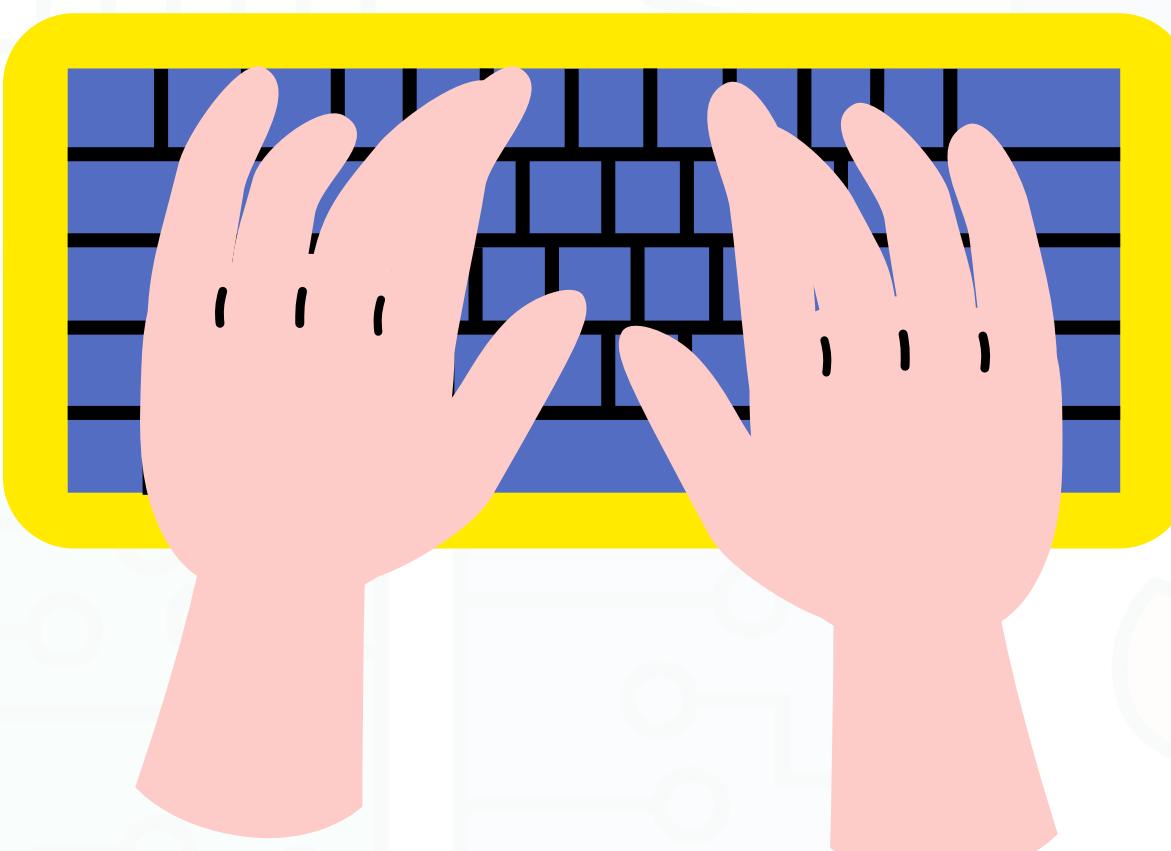
Code

To move the front left wheel

Knowing the pins of the motor are:

- Enable -> D6
- Input 1 -> D11
- Input2 -> D12

Hint: Remember the previous steps to move the front right wheel.



Move 2nd wheel

Step 1: Enabling the motor

```
void setup() {  
    pinMode(6, OUTPUT); //PWM pin  
    digitalWrite(6, HIGH); //set the PWM HIGH for now  
    pinMode(11, OUTPUT); //front left motor pin 1  
    pinMode(12, OUTPUT); //front left motor pin 2  
}
```



Move 2nd wheel

Step 2: Moving the wheel forwards

```
void loop() {  
    //forward  
    digitalWrite(11, HIGH);  
    digitalWrite(12, LOW);  
    delay(3000);  
  
    //stop  
    digitalWrite(11, LOW);  
    digitalWrite(12, LOW);  
    delay(100);
```

Move 2nd wheel

Step 3: Moving the wheel Backwards

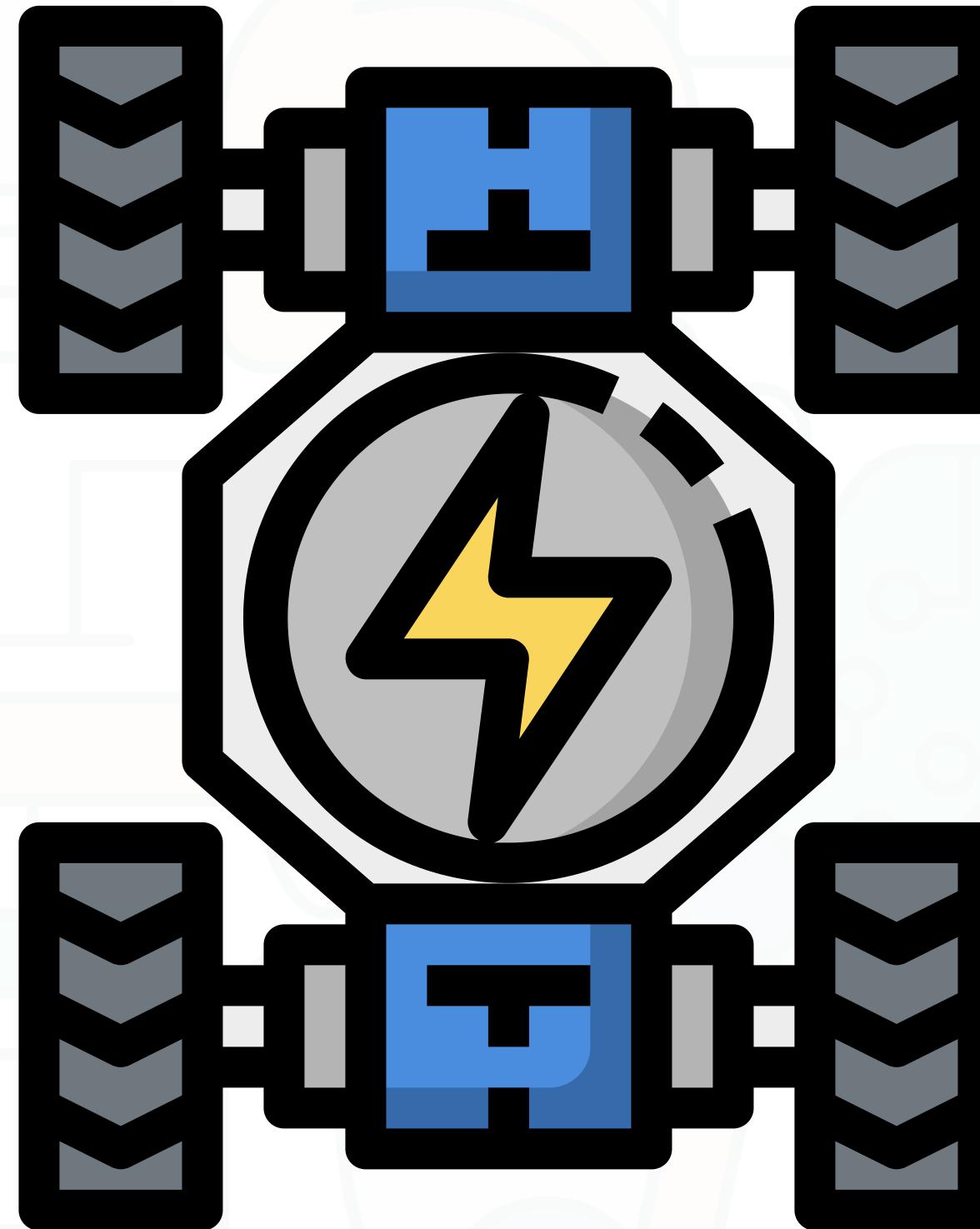
```
//backward  
digitalWrite(11, LOW);  
digitalWrite(12, HIGH);  
delay(3000);  
  
//stop  
digitalWrite(11, LOW);  
digitalWrite(12, LOW);  
delay(100);  
}
```

Let's move The Robot

Move Forward

Pins we need:

- Enable -> D6
- Input 1 -> D11
- Input2 -> D12



- Enable -> D5
- Input 1 -> D7
- Input2 -> D8

- Enable -> D10
- Input 1 -> A1(D15)
- Input2 -> A2(D16)

- Enable -> D9
- Input 1 -> D13
- Input2 -> A0(D14)

Let's move The Robot

Step 1: Enabling the motors

```
void setup() {  
    //define motors PWM pins  
    pinMode(5, OUTPUT); //back left motor PWM pin  
    pinMode(6, OUTPUT); //front left motor PWM pin  
    pinMode(9, OUTPUT); //back right motor PWM pin  
    pinMode(10, OUTPUT); //front right motor PWM pin  
  
    //setting all PWM pins to HIGH  
    digitalWrite(5, HIGH);  
    digitalWrite(6, HIGH);  
    digitalWrite(9, HIGH);  
    digitalWrite(10, HIGH);
```

Let's move The Robot

Step 2:Defining the Motors pins.

```
//defining motors directions pin  
pinMode(7, OUTPUT); //back left motor pin 1  
pinMode(8, OUTPUT); //back left motor pin 2  
  
pinMode(11, OUTPUT); //front left motor pin 1  
pinMode(12, OUTPUT); //front left motor pin 2  
  
pinMode(13, OUTPUT); //back right motor pin 1  
pinMode(A0, OUTPUT); //back right motor pin 2  
  
pinMode(A1, OUTPUT); //front right motor pin 1  
pinMode(A2, OUTPUT); //front right motor pin 2  
}
```

Let's move The Robot

Step 3: Moving the robot rwardIs forward

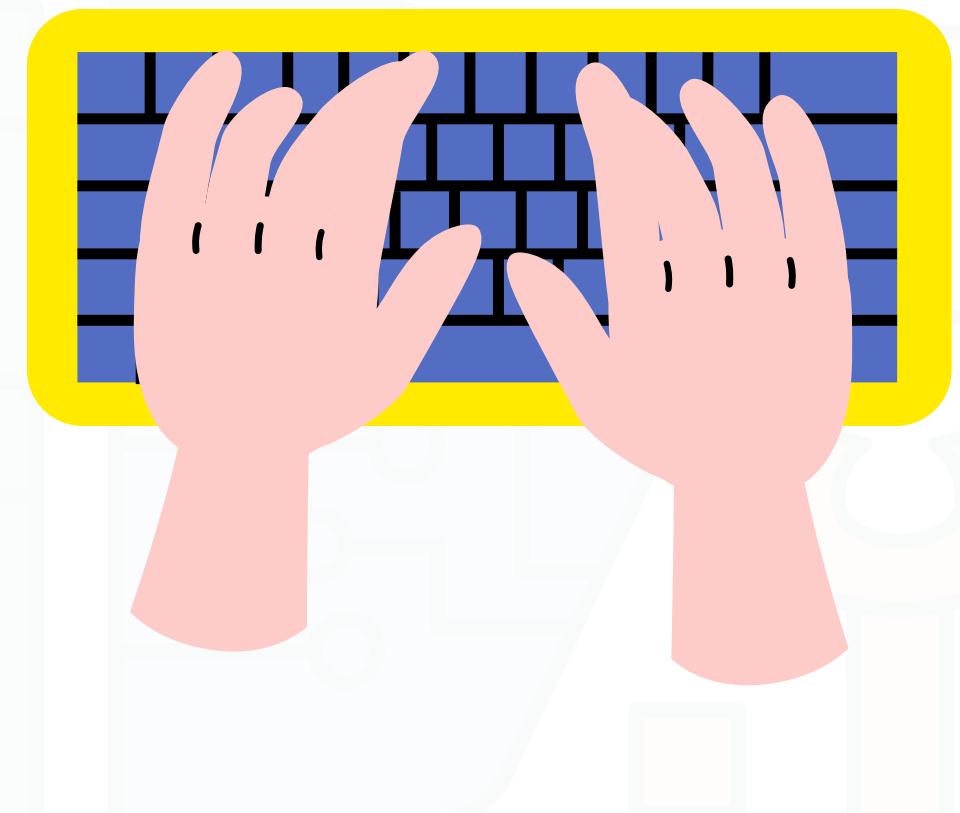
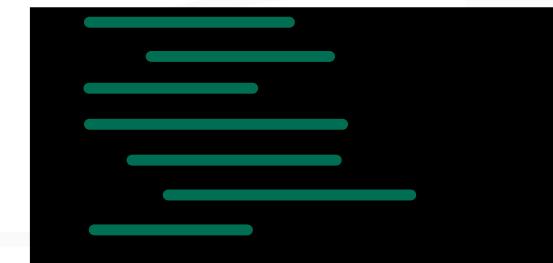
```
void loop() {  
    //////////////forward/////////////  
    //Back left motor foraward  
    digitalWrite(7, HIGH);  
    digitalWrite(8, LOW);  
    //front left motor foraward  
    digitalWrite(11, HIGH);  
    digitalWrite(12, LOW);  
    //back right motor foraward  
    digitalWrite(13, HIGH);  
    digitalWrite(A0, LOW);  
    //front right motor foraward  
    digitalWrite(A1, HIGH);  
    digitalWrite(A2, LOW);  
}
```

Code

Write a code to move the robot backward.

Try it by yourself

Hint: Reverse the outputs of the previous code.



Let's move The Robot

Step 1: Enabling the motors

```
void setup() {  
    //define motors PWM pins  
    pinMode(5, OUTPUT); //back left motor PWM pin  
    pinMode(6, OUTPUT); //front left motor PWM pin  
    pinMode(9, OUTPUT); //back right motor PWM pin  
    pinMode(10, OUTPUT); //front right motor PWM pin  
  
    //setting all PWM pins to HIGH  
    digitalWrite(5, HIGH);  
    digitalWrite(6, HIGH);  
    digitalWrite(9, HIGH);  
    digitalWrite(10, HIGH);
```

Let's move The Robot

Step 2:Defining the Motors pins.

```
//defining motors directions pin  
pinMode(7, OUTPUT); //back left motor pin 1  
pinMode(8, OUTPUT); //back left motor pin 2  
  
pinMode(11, OUTPUT); //front left motor pin 1  
pinMode(12, OUTPUT); //front left motor pin 2  
  
pinMode(13, OUTPUT); //back right motor pin 1  
pinMode(A0, OUTPUT); //back right motor pin 2  
  
pinMode(A1, OUTPUT); //front right motor pin 1  
pinMode(A2, OUTPUT); //front right motor pin 2  
}
```

Let's move The Robot

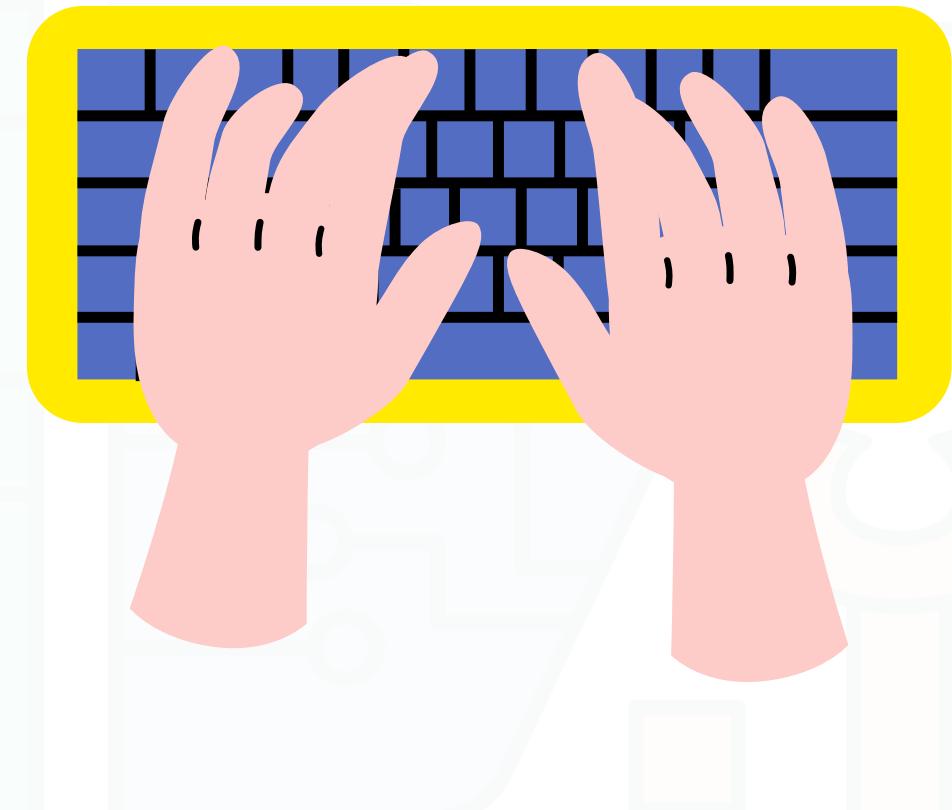
Step 3: Moving the robot backwards

```
void loop() {  
    ///////////////Backward/////////////  
    //Back left motor backward  
    digitalWrite(7, LOW);  
    digitalWrite(8, HIGH);  
    //front left motor backward  
    digitalWrite(11, LOW);  
    digitalWrite(12, HIGH);  
    //back right motor backward  
    digitalWrite(13, LOW);  
    digitalWrite(A0, HIGH);  
    //front right motor backward  
    digitalWrite(A1, LOW);  
    digitalWrite(A2, HIGH);  
}
```

Code

Write a code to move the robot forward and backward with a delay.

Try it by yourself



Let's move The Robot

Step 1: Enabling the motors

```
void setup() {  
    //define motors PWM pins  
    pinMode(5, OUTPUT); //back left motor PWM pin  
    pinMode(6, OUTPUT); //front left motor PWM pin  
    pinMode(9, OUTPUT); //back right motor PWM pin  
    pinMode(10, OUTPUT); //front right motor PWM pin  
  
    //setting all PWM pins to HIGH  
    digitalWrite(5, HIGH);  
    digitalWrite(6, HIGH);  
    digitalWrite(9, HIGH);  
    digitalWrite(10, HIGH);
```

Let's move The Robot

Step 2:Defining the Motors pins.

```
//defining motors directions pin  
pinMode(7, OUTPUT); //back left motor pin 1  
pinMode(8, OUTPUT); //back left motor pin 2  
  
pinMode(11, OUTPUT); //front left motor pin 1  
pinMode(12, OUTPUT); //front left motor pin 2  
  
pinMode(13, OUTPUT); //back right motor pin 1  
pinMode(A0, OUTPUT); //back right motor pin 2  
  
pinMode(A1, OUTPUT); //front right motor pin 1  
pinMode(A2, OUTPUT); //front right motor pin 2  
}
```

Let's move The Robot

Step 3: Moving the robot forward

```
void loop() {  
    //////////////forward/////////  
    //Back left motor foraward  
    digitalWrite(7, HIGH);  
    digitalWrite(8, LOW);  
    //front left motor foraward  
    digitalWrite(11, HIGH);  
    digitalWrite(12, LOW);  
    //back right motor foraward  
    digitalWrite(13, HIGH);  
    digitalWrite(A0, LOW);  
    //front right motor foraward  
    digitalWrite(A1, HIGH);  
    digitalWrite(A2, LOW);  
  
    delay(2500);
```

so it keeps
going for 2.5
secs

```
//////////stop/////////  
//Back left motor stop  
digitalWrite(7, LOW);  
digitalWrite(8, LOW);  
//front left motor stop  
digitalWrite(11, LOW);  
digitalWrite(12, LOW);  
//back right motor stop  
digitalWrite(13, LOW);  
digitalWrite(A0, LOW);  
//front right motor stop  
digitalWrite(A1, LOW);  
digitalWrite(A2, LOW);  
  
delay(100);
```

Let's move The Robot

Step 3: Moving the robot backwards

```
/////////Backward/////////  
//Back left motor backward  
digitalWrite(7, LOW);  
digitalWrite(8, HIGH);  
//front left motor backward  
digitalWrite(11, LOW);  
digitalWrite(12, HIGH);  
//back right motor backward  
digitalWrite(13, LOW);  
digitalWrite(A0, HIGH);  
//front right motor backward  
digitalWrite(A1, LOW);  
digitalWrite(A2, HIGH);  
  
delay(2500);
```

so it keeps
going for 2.5
secs

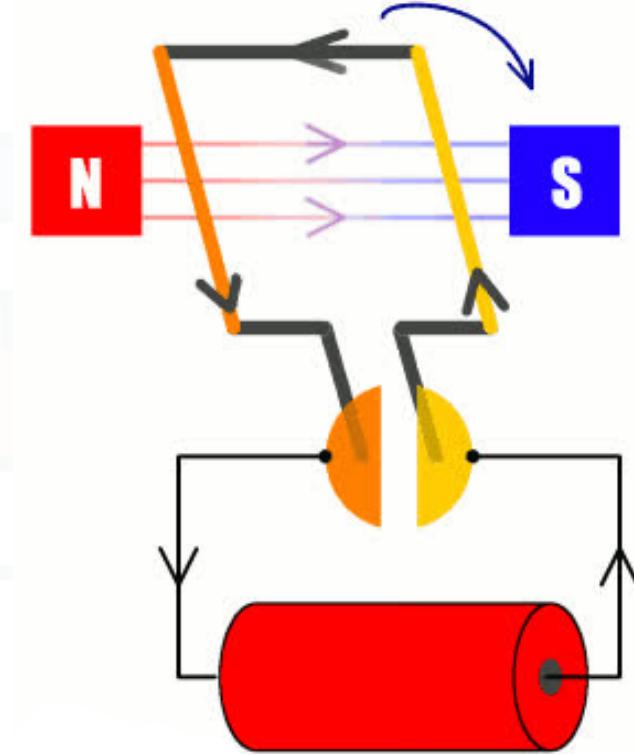
```
/////////stop/////////  
//Back left motor stop  
digitalWrite(7, LOW);  
digitalWrite(8, LOW);  
//front left motor stop  
digitalWrite(11, LOW);  
digitalWrite(12, LOW);  
//back right motor stop  
digitalWrite(13, LOW);  
digitalWrite(A0, LOW);  
//front right motor stop  
digitalWrite(A1, LOW);  
digitalWrite(A2, LOW);  
  
delay(100);
```



Summary

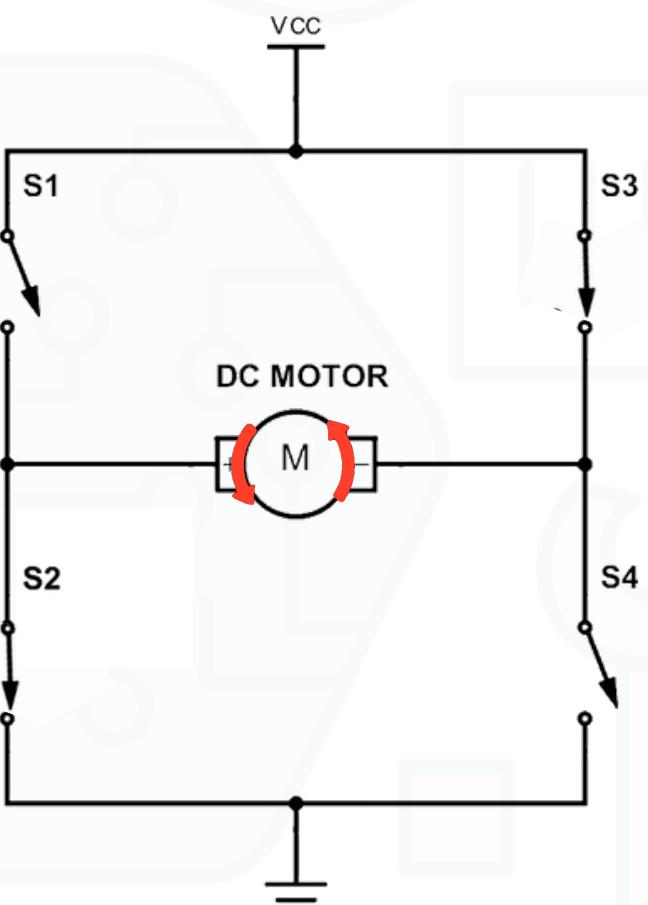
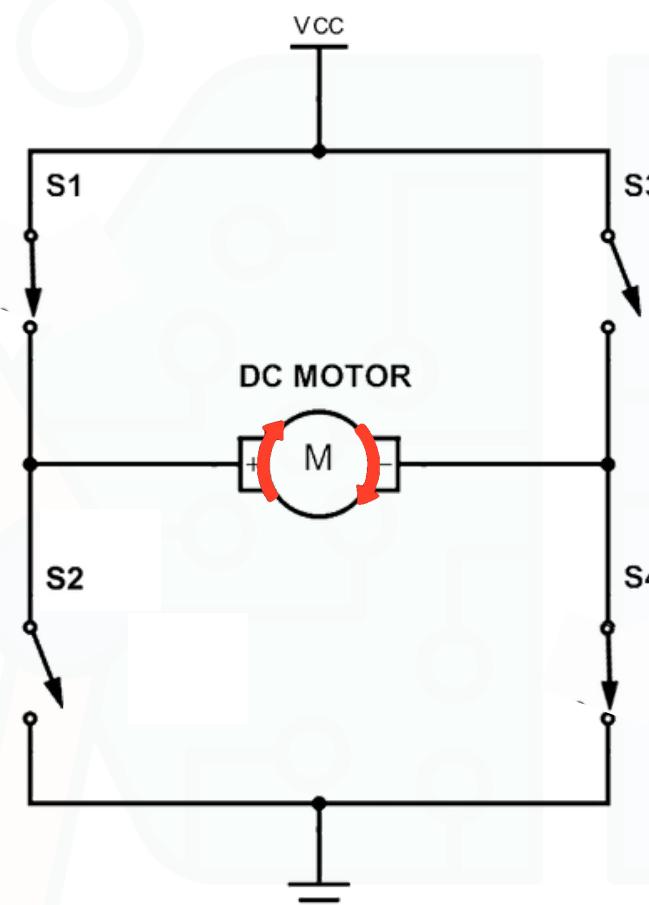
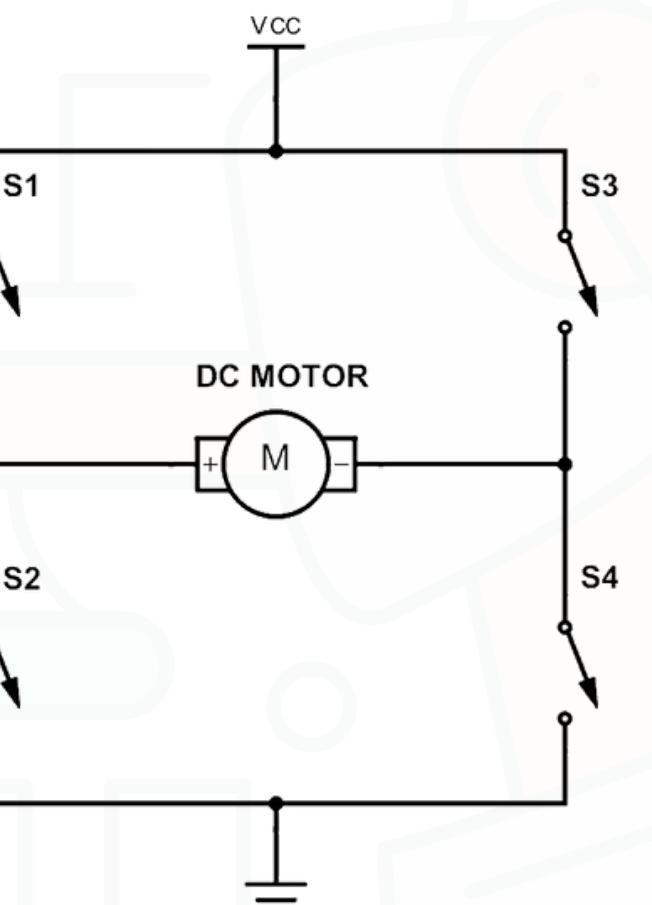
Motor

It is a device that converts electrical, chemical, or nuclear energy into mechanical energy.



Motor driver

It is a device that controls motor's movement (direction & speed) depending on its inputs and it consists of H bridge circuit .





Summary

Steps to Move 1 wheel

1. Enable motor.
2. Set input1.
3. Set input2.

Front right wheel code to move forward

Front right wheel code to move backward



Summary

Steps To Move the Robot forward

1. Enable all 4 motors.
2. Set inputs1 to the left motors to "HIGH" and inputs2 to "LOW".
3. Set inputs1 to the right motors to "HIGH" and inputs2 to "LOW".

To move the robot backward the outputs will be reversed

Step 1

Step 2

Step 3