



Armstrong

School Program 2023-2024

Orientation Session



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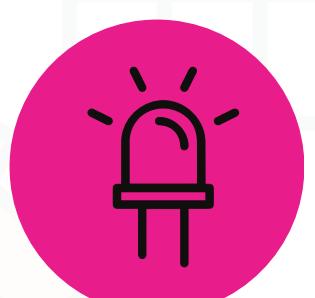
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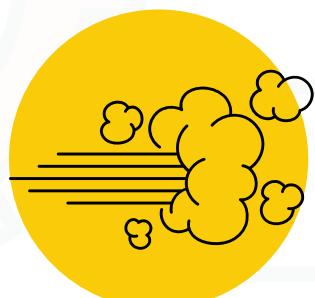
Lesson Content



Revising motor movement



PWM



Control speed



Remember

How to move wheel forward and backwards?

Pins:

- Enable -> D10
- Input 1 -> A1 (15)
- Input2 -> A2 (16)





Remember

How to move wheel forward and backwards?

```
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);
```

```
//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  
}
```



Remember

How to move wheel forward and backwards?

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

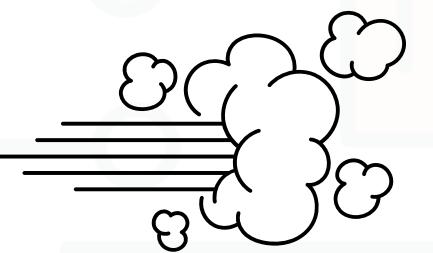
```
//////////stop/////////  
//Back left motor stop  
digitalWrite(7, LOW);  
digitalWrite(8, LOW);  
//front left motor stop  
digitalWrite(11, LOW);  
digitalWrite(12, LOW);  
//back right motor stop  
digitalWrite(13, LOW);  
digitalWrite(A0, LOW);  
//front right motor stop  
digitalWrite(A1, LOW);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

```
//////////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);
```

```
//////////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);
```

Think

How can we control robot's speed?

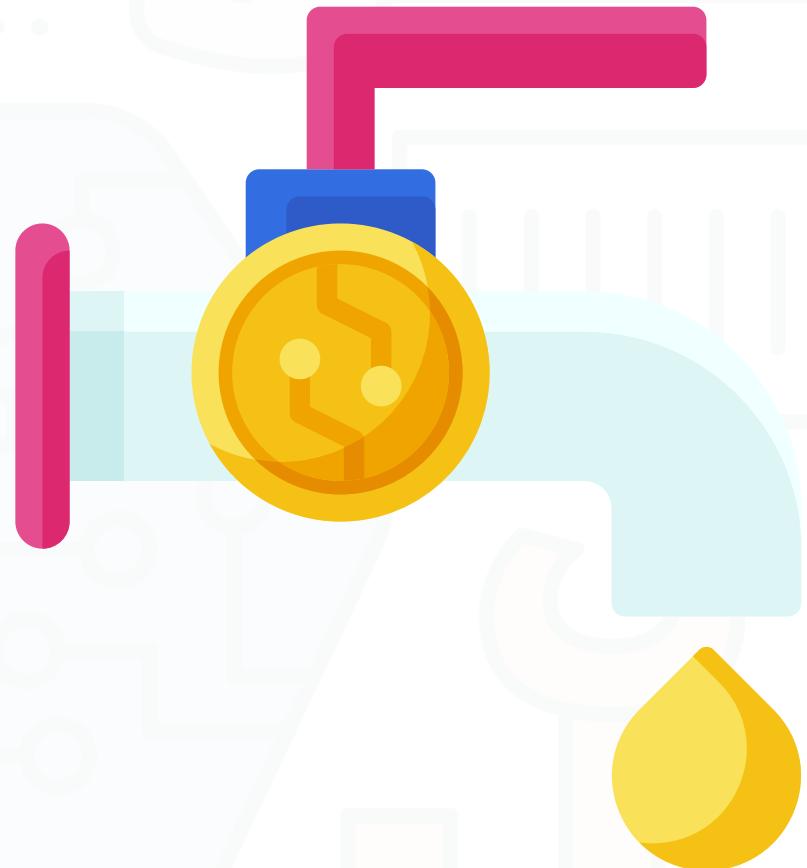


Analogy ≡

Imagine you have a faucet that can only be fully open or fully closed.

How can you control how much water comes out?

By turning the faucet on and off very quickly.



Analogy ≡

If you have to fill a bucket by turning the faucet on and off:

How can you get a small amount of water?

if you turn it on for a short time and then off for a long time.

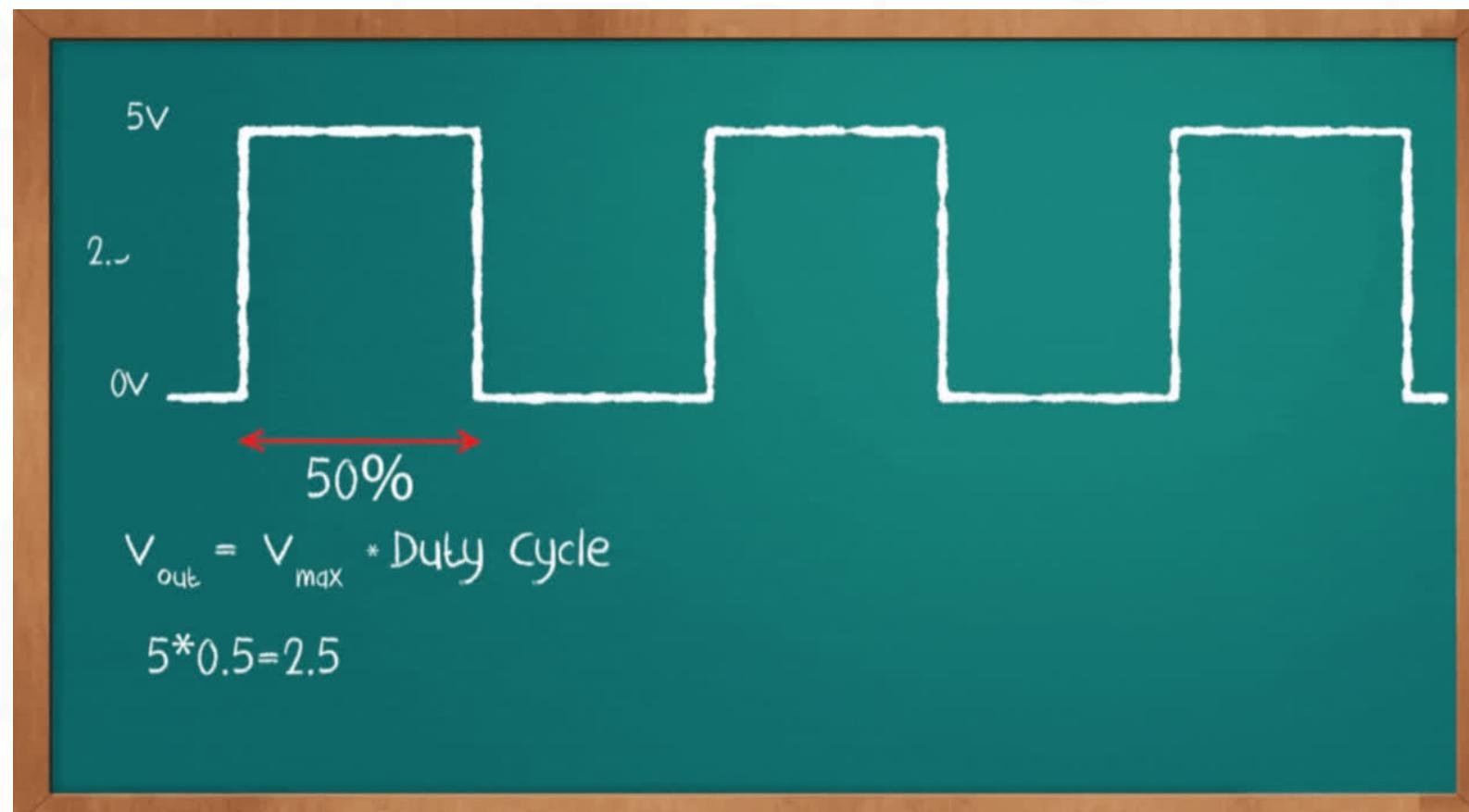


How can you get a bigger amount?

If you turn the faucet on for a long time and then off for a short time, you will get more water.

Analogy ≡

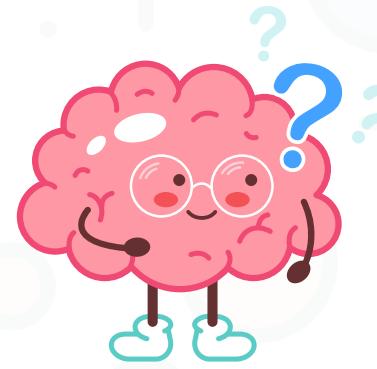
The amount of water that comes out depends on how long the faucet is on compared to how long it is off. This is called the **duty cycle**.



Duty cycle

The duty cycle is like the brightness of an LED. If the LED is on for a long time and then off for a short time, it will be brighter than if it is on for a short time and then off for a long time.

Think



If the switch is on for a long time and then off for a short time, the light bulb will be bright. If the switch is on for a short time and then off for a long time, the light bulb will be dim.

Can you see the flickering of the light?

Think



If the switch is on for a long time and then off for a short time, the light bulb will be bright. If the switch is on for a short time and then off for a long time, the light bulb will be dim.

Can you see the flickering of the light?

The human eye cannot see the flickering of the light, but it can perceive the average brightness.

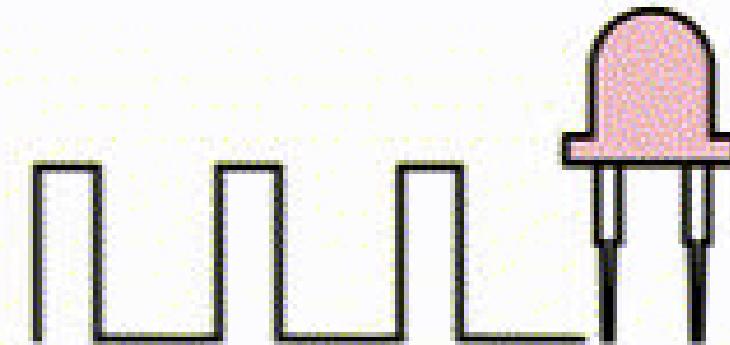
PWM

What does PWM stands for?

Pulse width modulation.

What is PWM?

PWM is a way to control the amount of electricity that goes to a device by turning it on and off very quickly, like a water faucet.

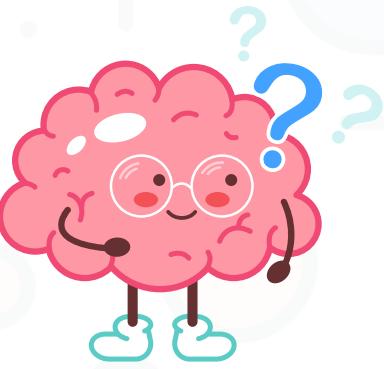


Think

Applications of PWM?

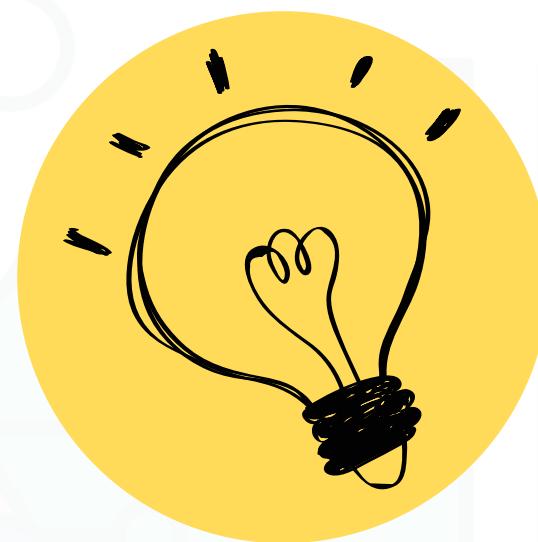
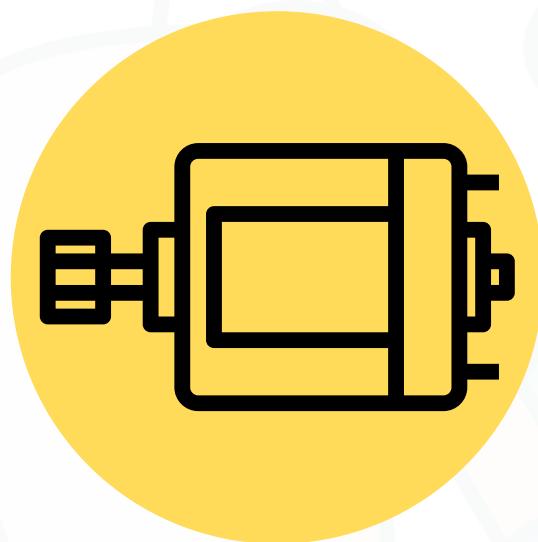


Think

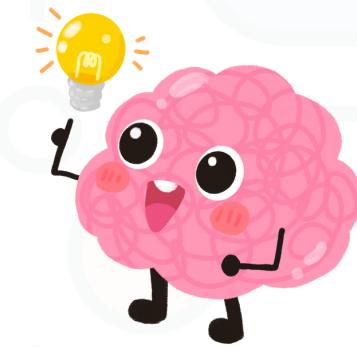


Applications of PWM

PWM can be used for various purposes, such as dimming an LED, producing audio signals, or controlling motor's speed.



Conclusion

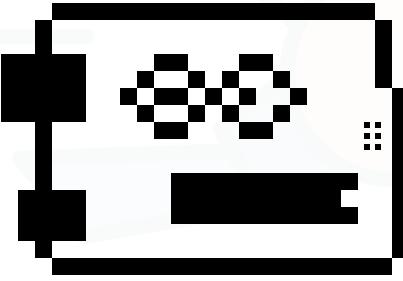


What do we conclude?

We can use the enable pin PWM to control ←
wheel's speed in a certain way.

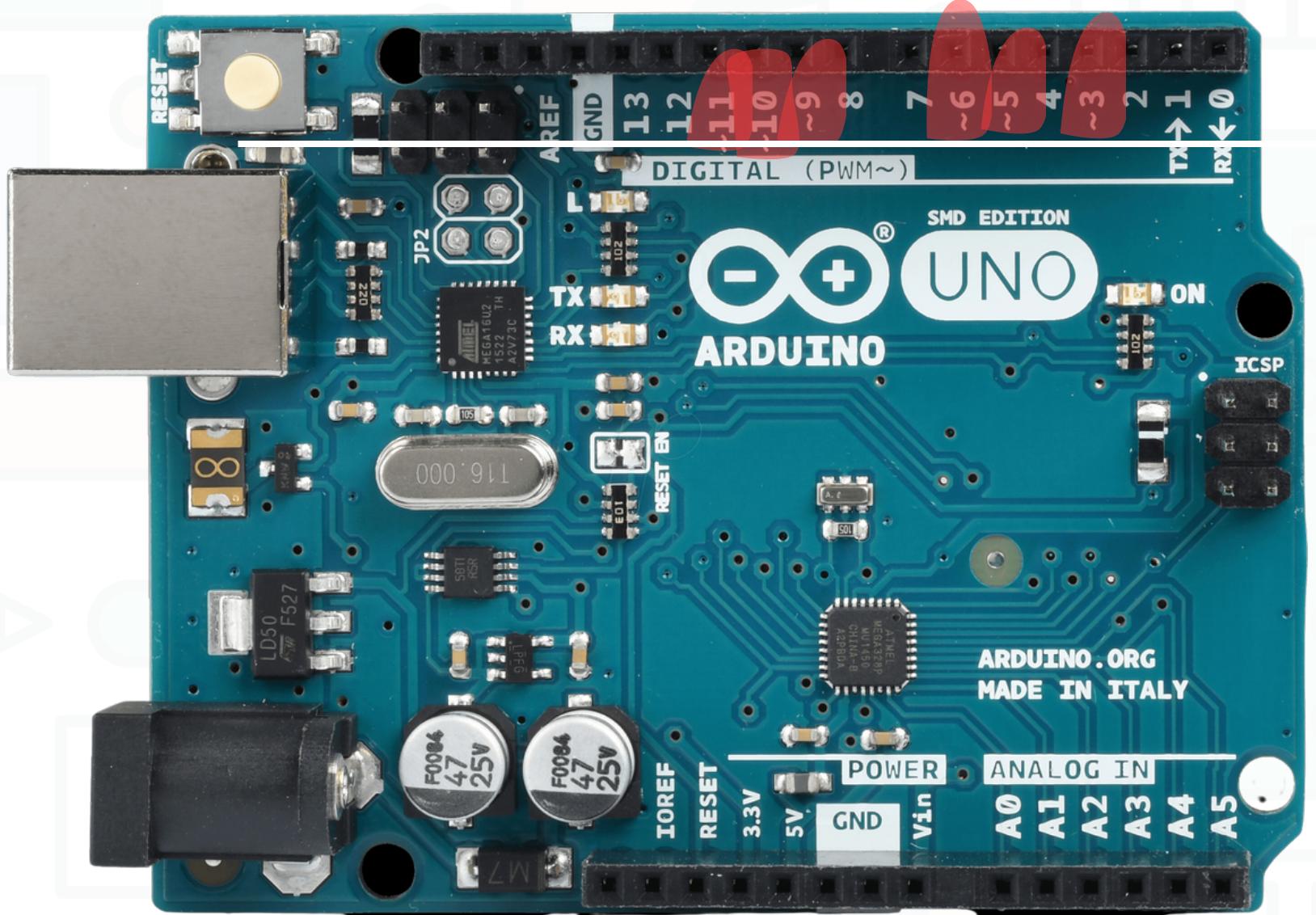
```
void setup() {  
    //define motors PWM pins  
    pinMode(6, OUTPUT); //front left motor PWM pin  
  
    pinMode(11, OUTPUT); //front left motor pin 1  
    pinMode(12, OUTPUT); //front left motor pin 2  
  
    //setting motor speed to 70/255  
    analogWrite(6, 70);  
}
```

PWM on Arduino



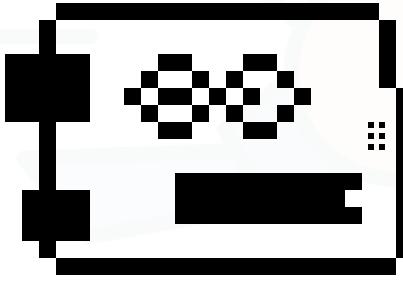
PWM pins

The PWM pins on Arduino are labeled with a ~ sign.



PWM pins are 3, 5, 6, 9, 10, 11.

PWM on Arduino



How to write the code



```
void setup() {  
    pinMode(5, OUTPUT);  
}
```

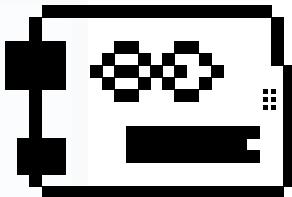
PWM pins 3, 5, 6, 9, 10, 11.

```
void loop() {  
    analogWrite(3, 0);
```

number between 0 and 255

Note

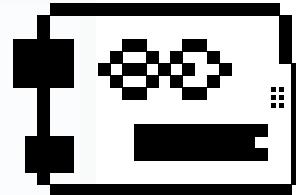
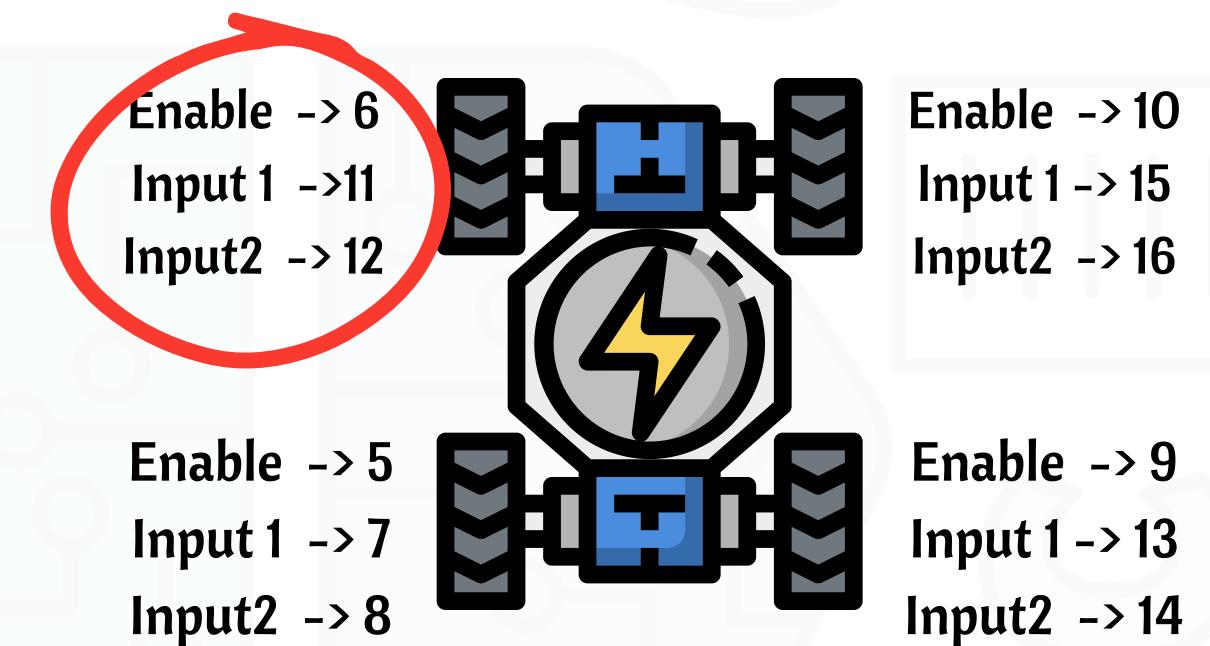
MOTOR	WHEEL	DIRECTION	SPEED
MOTOR 1	Back left wheel	D7, D8	D5
MOTOR 2	Front left wheel	D11, D12	D6
MOTOR 3	Back right wheel	D13, A0(14)	D9
MOTOR 4	Front right wheel	A1(15), A2(16)	D10



Code

Step 1: Write code to move first wheel forward with speed

Try it by yourself

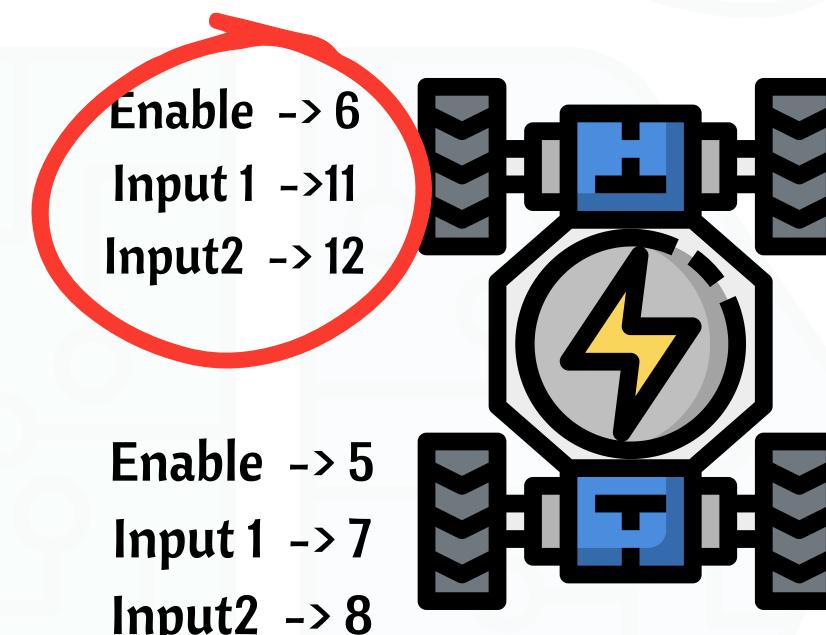


Code



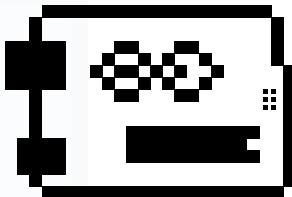
Step 1: Write code to move first wheel forward with speed

```
void setup() {  
    //define motors PWM pins  
    pinMode(6, OUTPUT); //front left motor PWM pin  
  
    pinMode(11, OUTPUT); //front left motor pin 1  
    pinMode(12, OUTPUT); //front left motor pin 2  
  
    //setting motor speed to 70/255  
    analogWrite(6, 70);  
}
```



Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14



Code

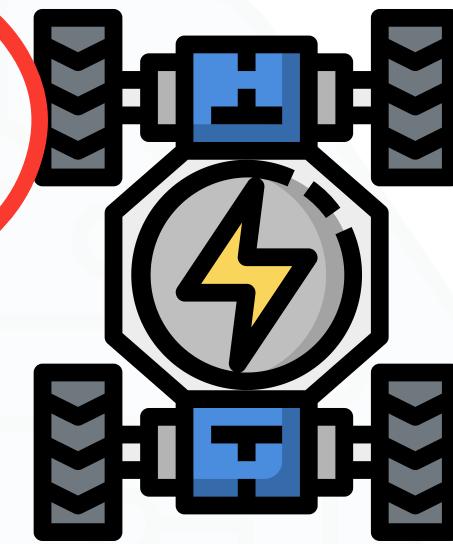


Step 1: Write code to move first wheel forward with speed

```
void setup() {  
    //define motors PWM pins  
    pinMode(6, OUTPUT); //front left motor PWM pin  
  
    pinMode(11, OUTPUT); //front left motor pin 1  
    pinMode(12, OUTPUT); //front left motor pin 2  
  
    //setting motor speed to 70/255  
    analogWrite(6, 70);  
}
```

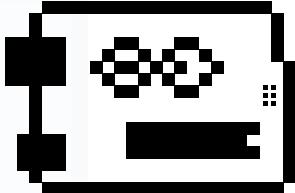
```
void loop() {  
    //front left motor forward  
    digitalWrite(11, HIGH);  
    digitalWrite(12, LOW);  
}
```

Enable -> 6
Input 1 -> 11
Input2 -> 12



Enable -> 10
Input 1 -> 15
Input2 -> 16

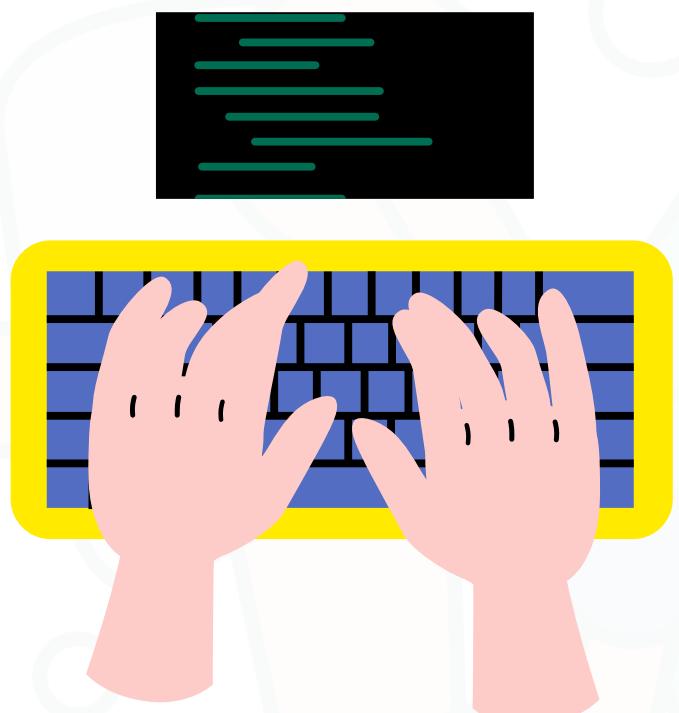
Enable -> 9
Input 1 -> 13
Input2 -> 14



Code

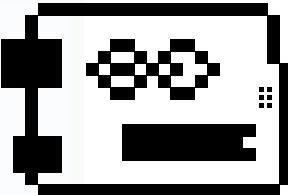
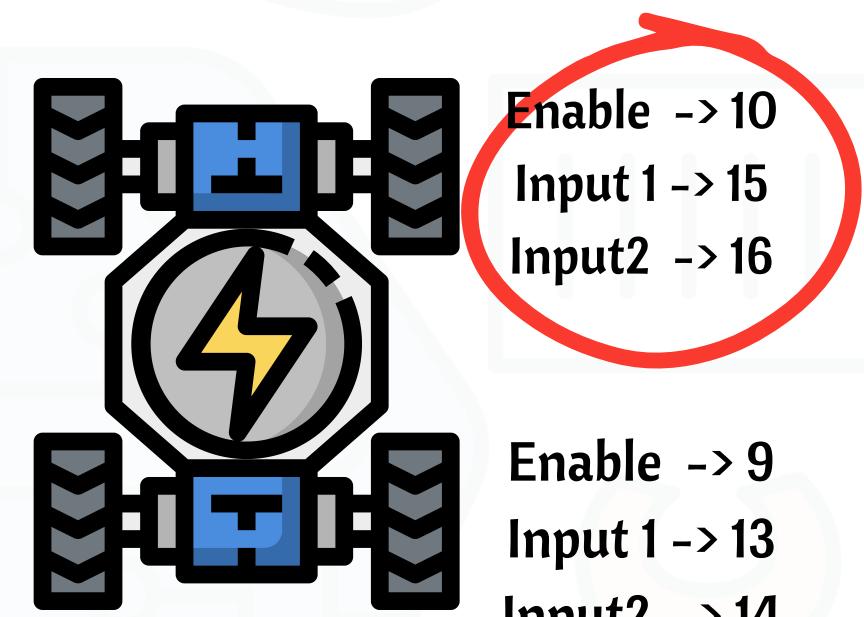
Step 2: Write code to move second wheel forward with speed

Try it by yourself



Enable -> 6
Input 1 ->11
Input2 -> 12

Enable -> 5
Input 1 -> 7
Input2 -> 8

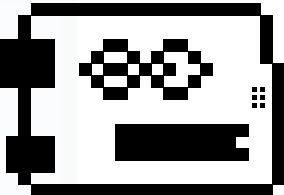


Code

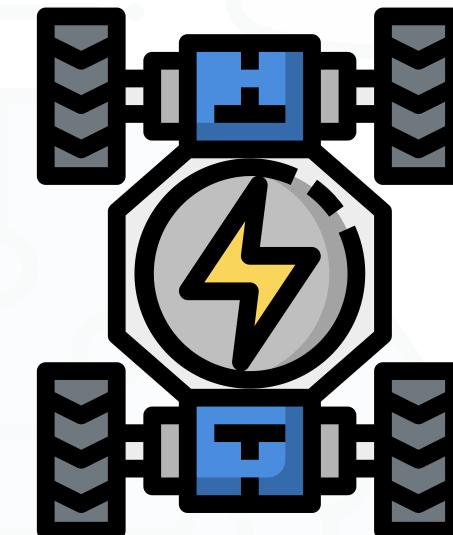


Step 2: Write code to move second wheel forward with speed

```
void setup() {  
    //define motors PWM pins  
    pinMode(6, OUTPUT); //front left motor PWM pin  
    pinMode(10, OUTPUT); //front right motor PWM pin  
  
    //defining motors directions pin  
    pinMode(11, OUTPUT); //front left motor pin 1  
    pinMode(12, OUTPUT); //front left motor pin 2  
  
    pinMode(A1, OUTPUT); //front right motor pin 1  
    pinMode(A2, OUTPUT); //front right motor pin 2  
  
    //setting motors speeds to 70/255  
    analogWrite(6, 70);  
    analogWrite(10, 70);  
}
```



Enable -> 6
Input 1 -> 11
Input2 -> 12



Enable -> 5
Input 1 -> 7
Input2 -> 8

Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14

Code

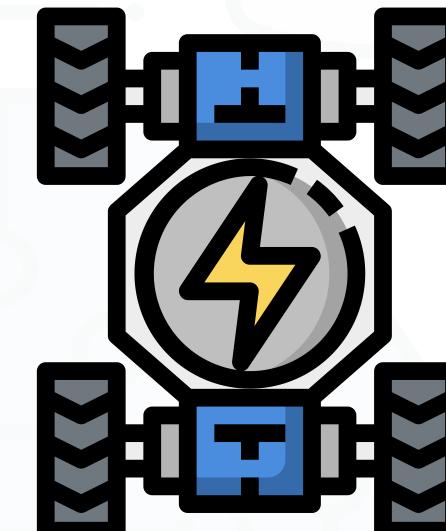


Step 2: Write code to move second wheel forward with speed

```
void setup() {  
    //define motors PWM pins  
    pinMode(6, OUTPUT); //front left motor PWM pin  
    pinMode(10, OUTPUT); //front right motor PWM pin  
  
    //defining motors directions pin  
    pinMode(11, OUTPUT); //front left motor pin 1  
    pinMode(12, OUTPUT); //front left motor pin 2  
  
    pinMode(A1, OUTPUT); //front right motor pin 1  
    pinMode(A2, OUTPUT); //front right motor pin 2  
  
    //setting motors speeds to 70/255  
    analogWrite(6, 70);  
    analogWrite(10, 70);  
}  
 
```

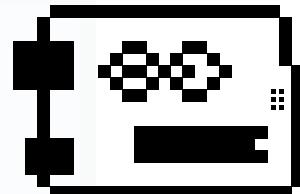
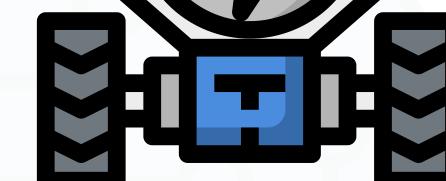
```
void loop() {  
    //front left motor forward  
    digitalWrite(11, HIGH);  
    digitalWrite(12, LOW);  
    //front right motor forward  
    digitalWrite(A1, HIGH);  
    digitalWrite(A2, LOW);  
}
```

Enable -> 6
Input 1 -> 11
Input2 -> 12



Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 5
Input 1 -> 7
Input2 -> 8



Code

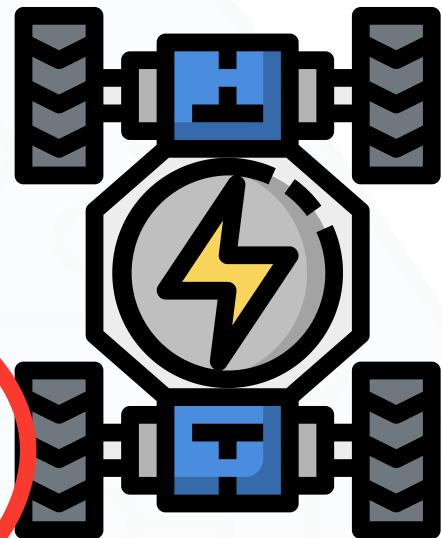
Step 3: Write code to move third wheel forward with speed

Try it by yourself



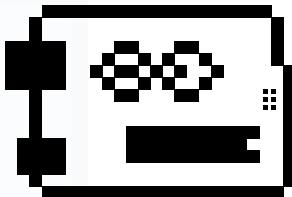
Enable -> 6
Input 1 -> 11
Input2 -> 12

Enable -> 5
Input 1 -> 7
Input2 -> 8



Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14

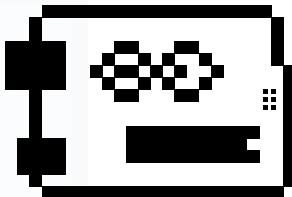
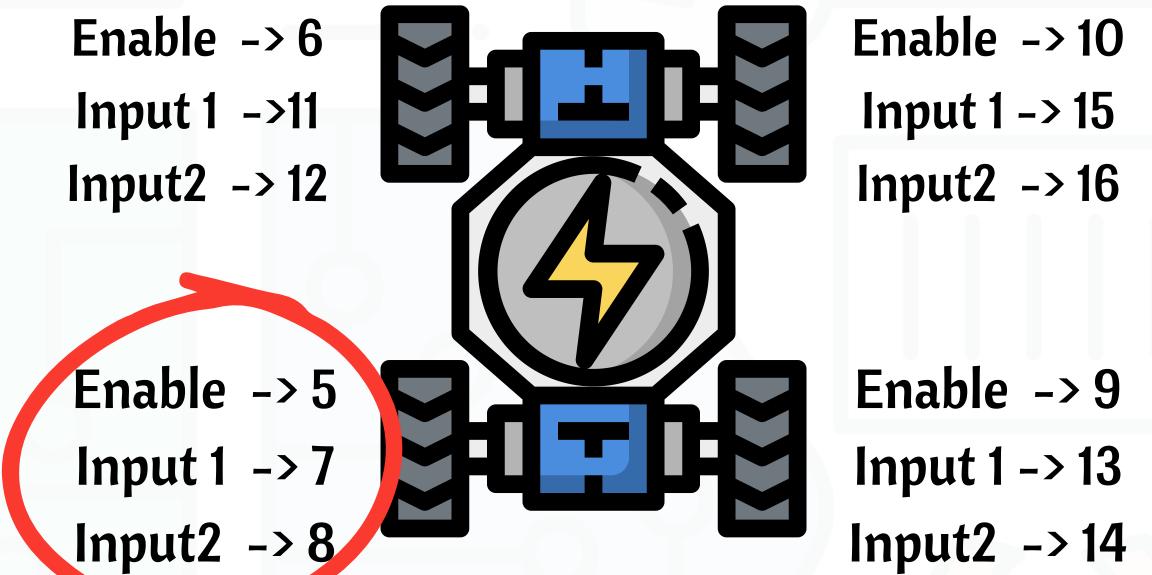


Code



Step 3: Write code to move third wheel forward with speed

```
void setup() {  
    //define motors PWM pins  
    pinMode(5, OUTPUT); //back left motor PWM pin  
    pinMode(6, OUTPUT); //front left motor PWM pin  
    pinMode(10, OUTPUT); //front right motor PWM pin  
  
    //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(A1, OUTPUT); //front right motor pin 1  
    pinMode(A2, OUTPUT); //front right motor pin 2  
  
    //setting motors speeds to 70/255  
    analogWrite(5, 70);  
    analogWrite(6, 70);  
    analogWrite(10, 70);  
}
```



Code



Step 3: Write code to move third wheel forward with speed

```
void setup() {  
    //define motors PWM pins  
    pinMode(5, OUTPUT); //back left motor PWM pin  
    pinMode(6, OUTPUT); //front left motor PWM pin  
    pinMode(10, OUTPUT); //front right motor PWM pin  
  
    //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(A1, OUTPUT); //front right motor pin 1  
    pinMode(A2, OUTPUT); //front right motor pin 2  
  
    //setting motors speeds to 70/255  
    analogWrite(5, 70);  
    analogWrite(6, 70);  
    analogWrite(10, 70);  
}  
 
```

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

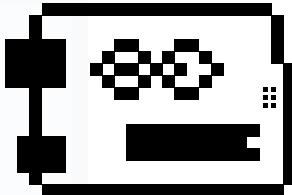
Enable -> 6
Input 1 -> 11
Input2 -> 12

Enable -> 5
Input 1 -> 7
Input2 -> 8



Enable -> 10
Input 1 -> 15
Input2 -> 16

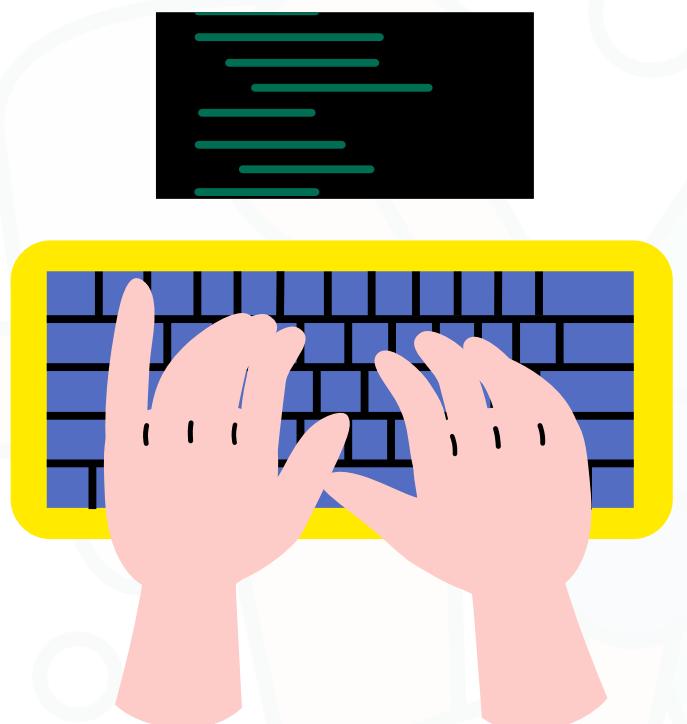
Enable -> 9
Input 1 -> 13
Input2 -> 14



Code

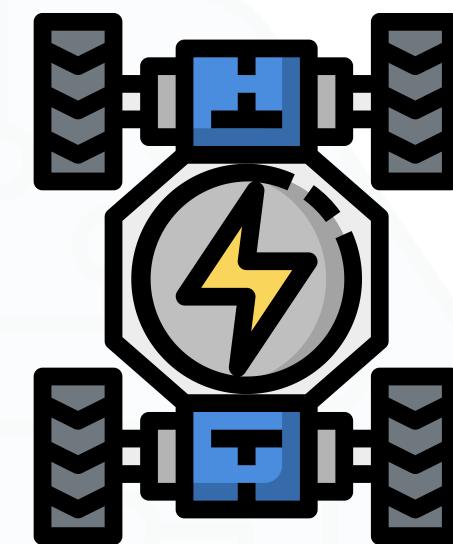
Step 4: Write code to move forth wheel forward with speed

Try it by yourself



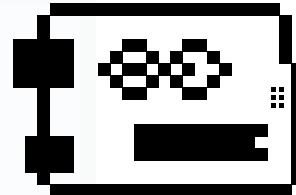
Enable -> 6
Input 1 ->11
Input2 -> 12

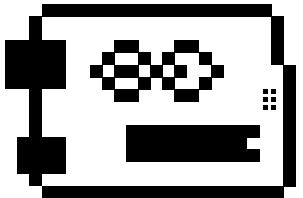
Enable -> 5
Input 1 -> 7
Input2 -> 8



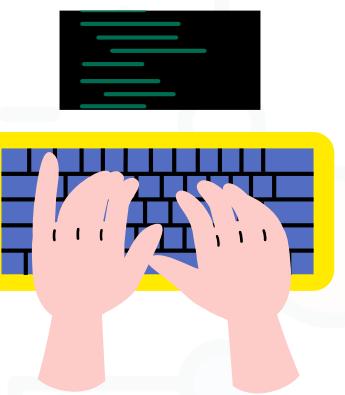
Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14





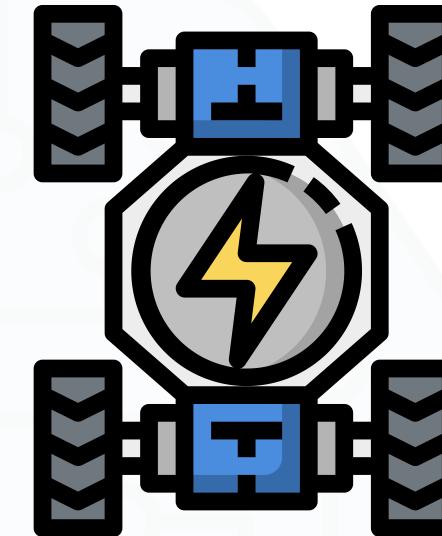
Code



Step 4: Write code to move forth wheel forward with speed

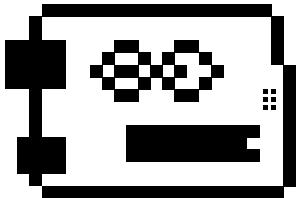
```
void setup() {  
    //define motors PWM pins  
    pinMode(5, OUTPUT); //back left motor PWM pin  
    pinMode(6, OUTPUT); //front left motor PWM pin  
    pinMode(9, OUTPUT); //back right motor PWM pin  
    pinMode(10, OUTPUT); //front right motor PWM pin  
  
    //defining motors directions 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  
  
    //setting motors speeds to 70/255  
    analogWrite(5, 70);  
    analogWrite(6, 70);  
    analogWrite(9, 70);  
    analogWrite(10, 70);  
}
```

Enable -> 6
Input 1 -> 11
Input2 -> 12



Enable -> 10
Input 1 -> 15
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Enable -> 9
Input 1 -> 13
Input2 -> 14



Code



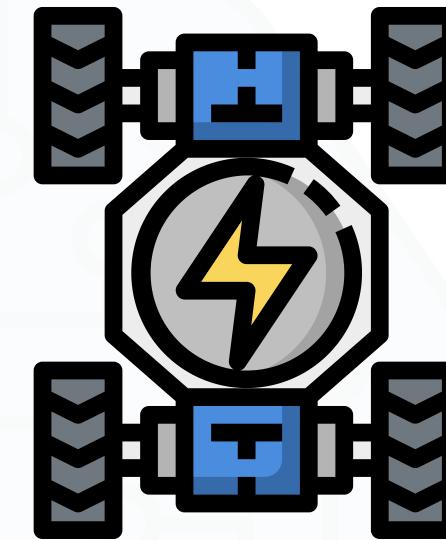
Step 4: Write code to move forth wheel forward with speed

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    pinMode(5, OUTPUT); //back left motor PWM pin  
    pinMode(6, OUTPUT); //front left motor PWM pin  
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    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  
  
    //setting motors speeds to 70/255  
    analogWrite(5, 70);  
    analogWrite(6, 70);  
    analogWrite(9, 70);  
    analogWrite(10, 70);  
}  
 
```

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

Enable -> 6
Input 1 -> 11
Input2 -> 12

Enable -> 5
Input 1 -> 7
Input2 -> 8



Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14

Code

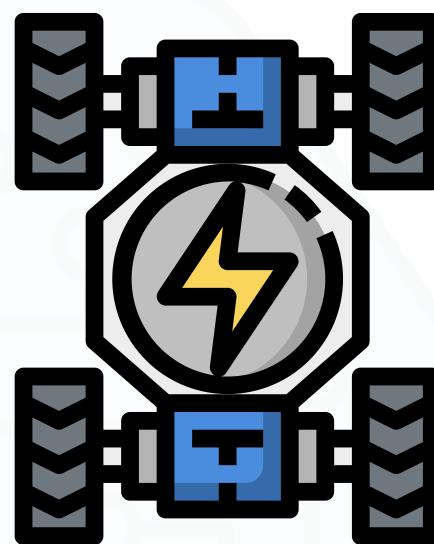
Step 5: Write code to move robot backwards with speed

Try it by yourself



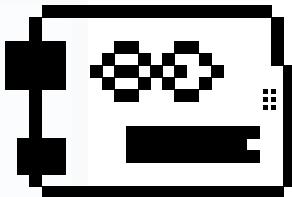
Enable -> 6
Input 1 -> 11
Input2 -> 12

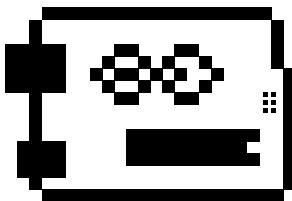
Enable -> 5
Input 1 -> 7
Input2 -> 8



Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14





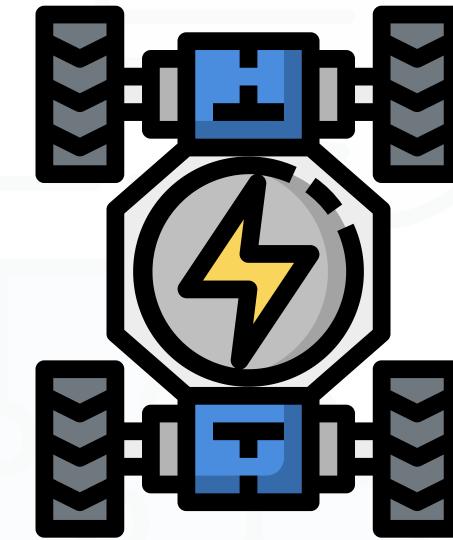
Code



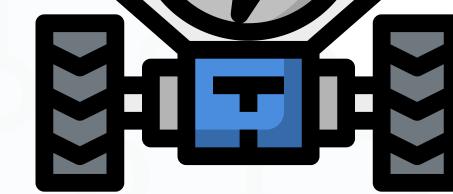
Step 5: Write code to move robot backwards with speed

```
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  
  
    //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  
  
    //setting motors speeds to 70/255  
    analogWrite(5, 70);  
    analogWrite(6, 70);  
    analogWrite(9, 70);  
    analogWrite(10, 70);  
}
```

Enable -> 6
Input 1 -> 11
Input2 -> 12

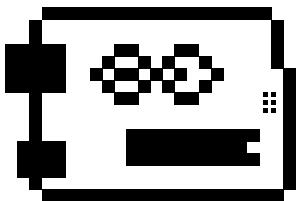


Enable -> 5
Input 1 -> 7
Input2 -> 8



Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14



Code

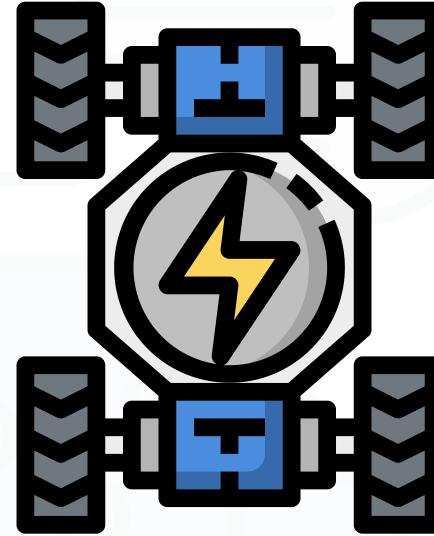


Step 5: Write code to move robot backwards with speed

```
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  
  
    //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  
  
    //setting motors speeds to 70/255  
    analogWrite(5, 70);  
    analogWrite(6, 70);  
    analogWrite(9, 70);  
    analogWrite(10, 70);  
}  
 
```

```
void loop() {  
    //////////////forward/////////////  
    //front left motor forward  
    digitalWrite(11, HIGH);  
    digitalWrite(12, LOW);  
    //Back right motor forward  
    digitalWrite(13, HIGH);  
    digitalWrite(A0, LOW);  
    //front right motor forward  
    digitalWrite(A1, HIGH);  
    digitalWrite(A2, LOW);  
    //back left motor forward  
    digitalWrite(7, HIGH);  
    digitalWrite(8, LOW);  
  
    delay(2000);  
}
```

Enable -> 6
Input 1 -> 11
Input 2 -> 12

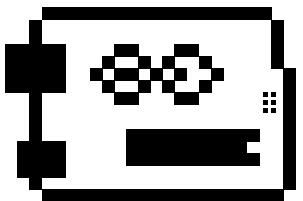


Enable -> 10
Input 1 -> 15
Input 2 -> 16

Enable -> 5
Input 1 -> 7
Input 2 -> 8



Enable -> 9
Input 1 -> 13
Input 2 -> 14



Code

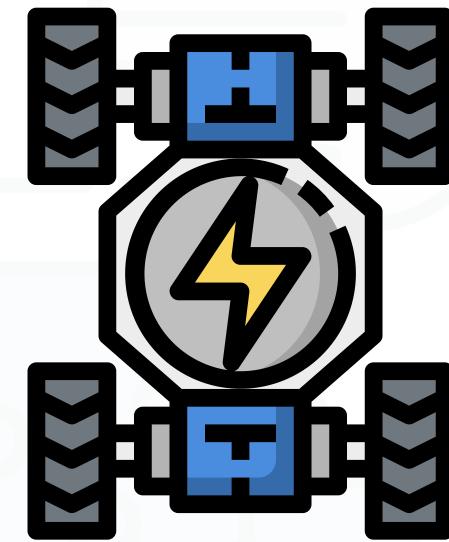


Step 5: Write code to move robot backwards with speed

```
void loop() {  
    //forward  
    //front left motor forward  
    digitalWrite(11, HIGH);  
    digitalWrite(12, LOW);  
    //Back right motor forward  
    digitalWrite(13, HIGH);  
    digitalWrite(A0, LOW);  
    //front right motor forward  
    digitalWrite(A1, HIGH);  
    digitalWrite(A2, LOW);  
    //back left motor forward  
    digitalWrite(7, HIGH);  
    digitalWrite(8, LOW);  
  
    delay(2000);
```



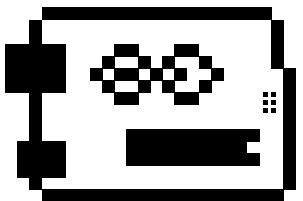
Enable -> 6
Input 1 -> 11
Input2 -> 12



Enable -> 5
Input 1 -> 7
Input2 -> 8

Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14



Code

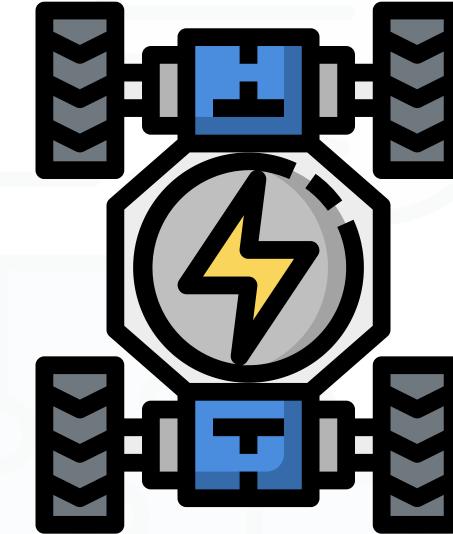


Step 5: Write code to move robot backwards with speed

```
void loop() {  
    //forward  
    //front left motor forward  
    digitalWrite(11, HIGH);  
    digitalWrite(12, LOW);  
    //Back right motor forward  
    digitalWrite(13, HIGH);  
    digitalWrite(A0, LOW);  
    //front right motor forward  
    digitalWrite(A1, HIGH);  
    digitalWrite(A2, LOW);  
    //back left motor forward  
    digitalWrite(7, HIGH);  
    digitalWrite(8, LOW);  
  
    delay(2000);
```

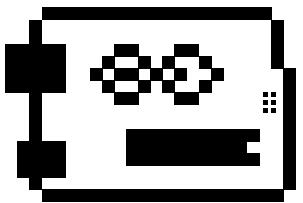
```
//////////stop/////////  
//front left motor forward  
digitalWrite(11, LOW);  
digitalWrite(12, LOW);  
//Back right motor forward  
digitalWrite(13, LOW);  
digitalWrite(A0, LOW);  
//front right motor forward  
digitalWrite(A1, LOW);  
digitalWrite(A2, LOW);  
//back left motor forward  
digitalWrite(7,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

Enable -> 6
Input 1 -> 11
Input2 -> 12



Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14



Code

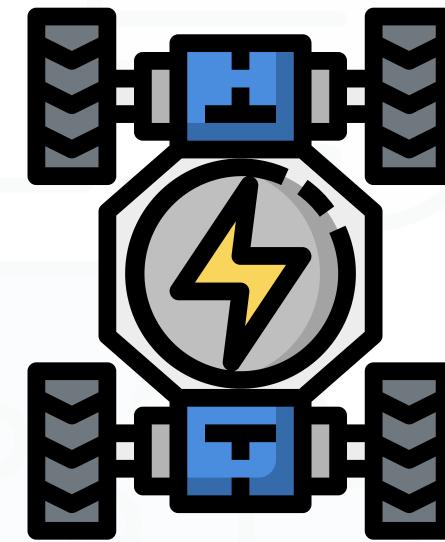


Step 5: Write code to move robot backwards with speed

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



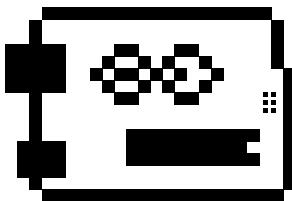
Enable -> 6
Input 1 ->11
Input2 -> 12



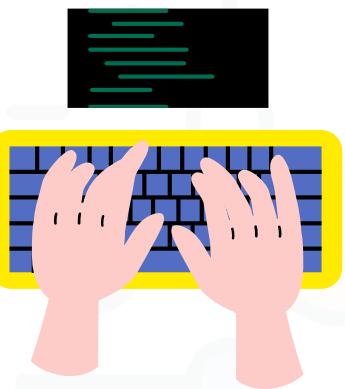
Enable -> 5
Input 1 -> 7
Input2 -> 8

Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14



Code

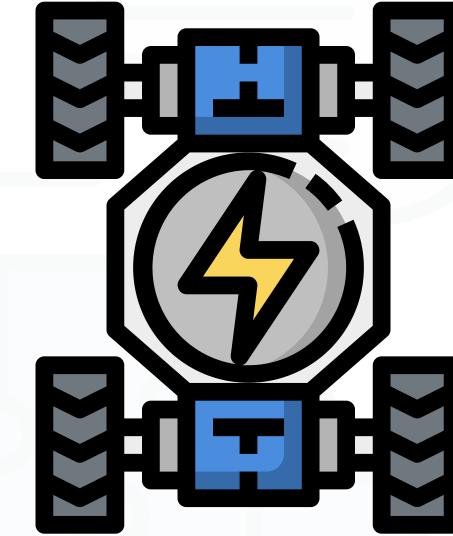


Step 5: Write code to move robot backwards with speed

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

```
//////////backward/////////  
//front left motor backward  
digitalWrite(11, HIGH);  
digitalWrite(12, LOW);  
//Back right motor backward  
digitalWrite(13, HIGH);  
digitalWrite(A0, LOW);  
//front right motor backward  
digitalWrite(A1, HIGH);  
digitalWrite(A2, LOW);  
//back left motor backward  
digitalWrite(7, HIGH);  
digitalWrite(8, LOW);  
  
delay(2000);
```

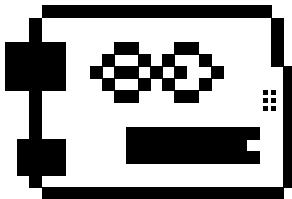
Enable -> 6
Input 1 -> 11
Input2 -> 12



Enable -> 5
Input 1 -> 7
Input2 -> 8

Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14



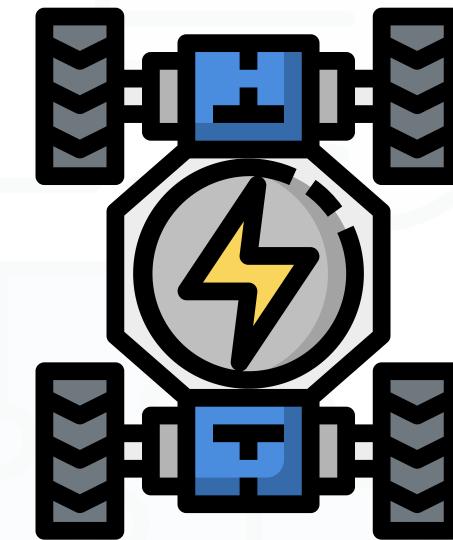
Code



Step 5: Write code to move robot backwards with speed

```
////////backward/////////  
//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);  
//back left motor backward  
digitalWrite(7, LOW);  
digitalWrite(8, HIGH);  
  
delay(2000);
```

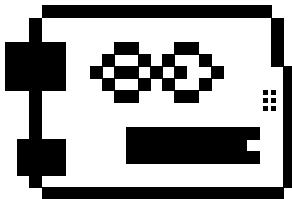
Enable -> 6
Input 1 ->11
Input2 -> 12



Enable -> 5
Input 1 -> 7
Input2 -> 8

Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14



Code

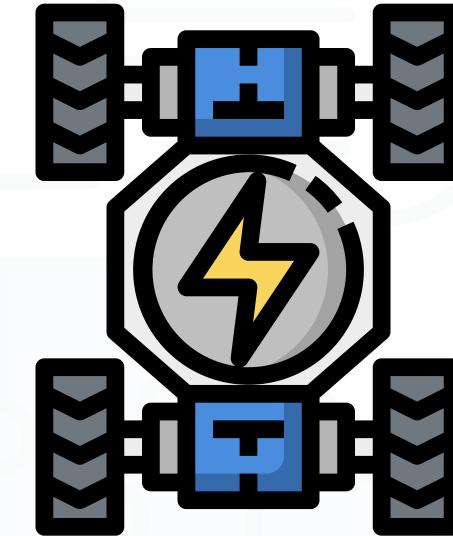


Step 5: Write code to move robot backwards with speed

```
/////////backward/////////  
//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);  
//back left motor backward  
digitalWrite(7, LOW);  
digitalWrite(8, HIGH);  
  
delay(2000);
```

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

Enable -> 6
Input 1 -> 11
Input2 -> 12



Enable -> 5
Input 1 -> 7
Input2 -> 8

Enable -> 10
Input 1 -> 15
Input2 -> 16

Enable -> 9
Input 1 -> 13
Input2 -> 14



Remember

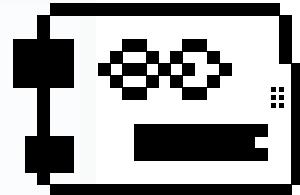
```
void loop() {  
    analogWrite(3, 0);
```

number between 0 and 255

Code

Step 6: Experiment with different speeds

Try it by yourself



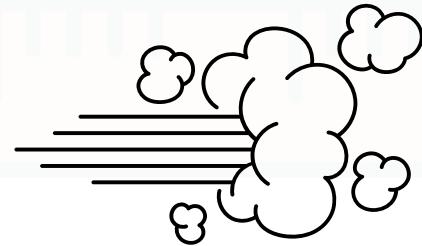
Observe

What did you notice?



Think

What if we tried different speeds for each wheel?



Code

Try different speeds for each wheel

Try it by yourself

