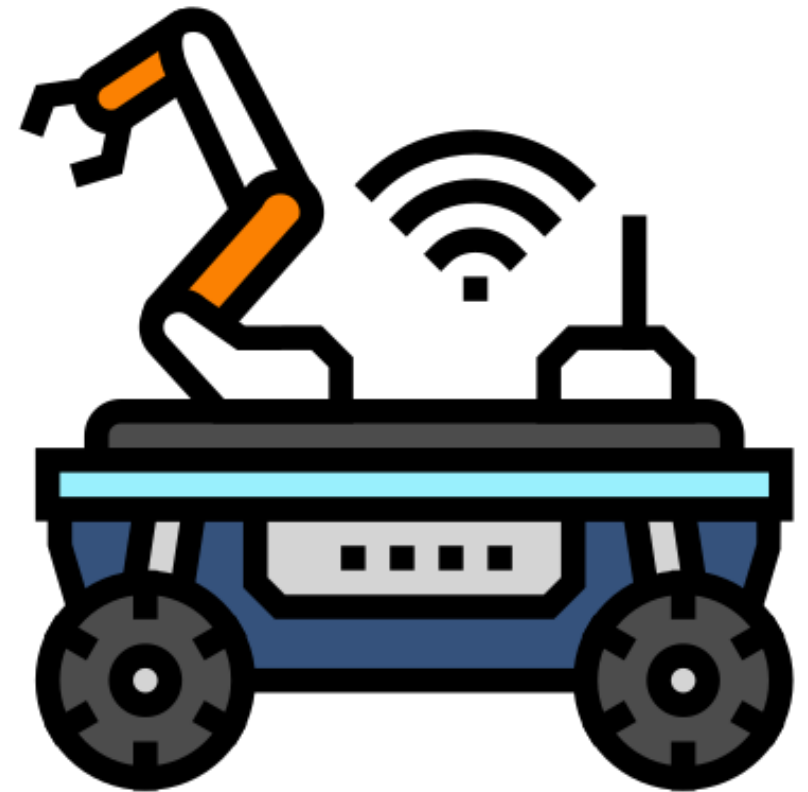


WORKSHOP ROBOTIK

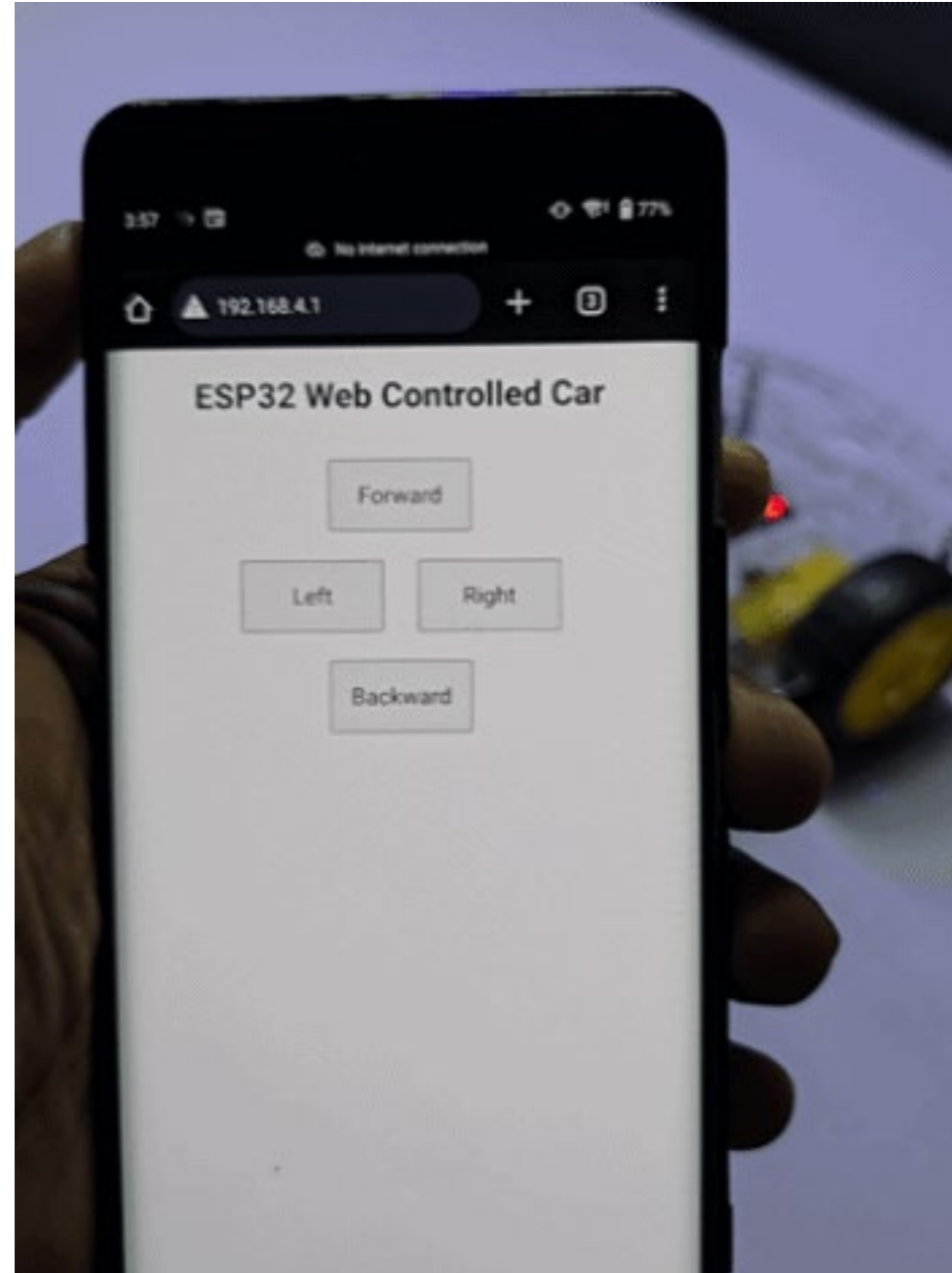
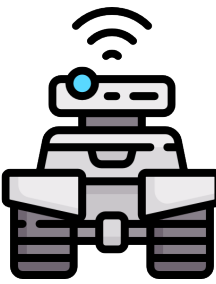
Kendali Robot Car Berbasis ESP32 melalui Bluetooth

Minggu, 26 Oktober 2025

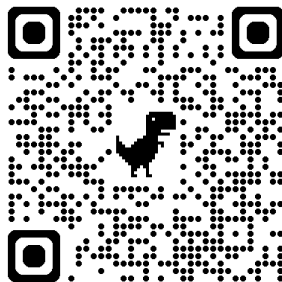


Syafriyadi Nor, S.T., M.T.

Case Study

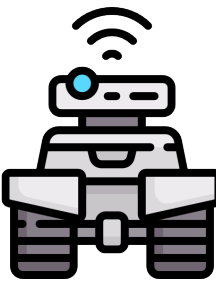


Reference



Kendali Robot Car Berbasis ESP32 melalui Bluetooth

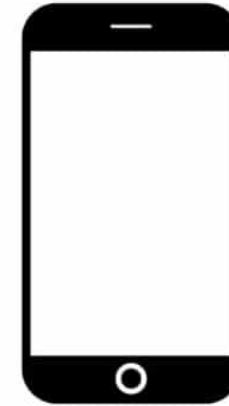
Required Components



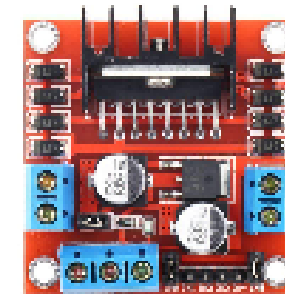
Car Chassis Kit



Microcontroller



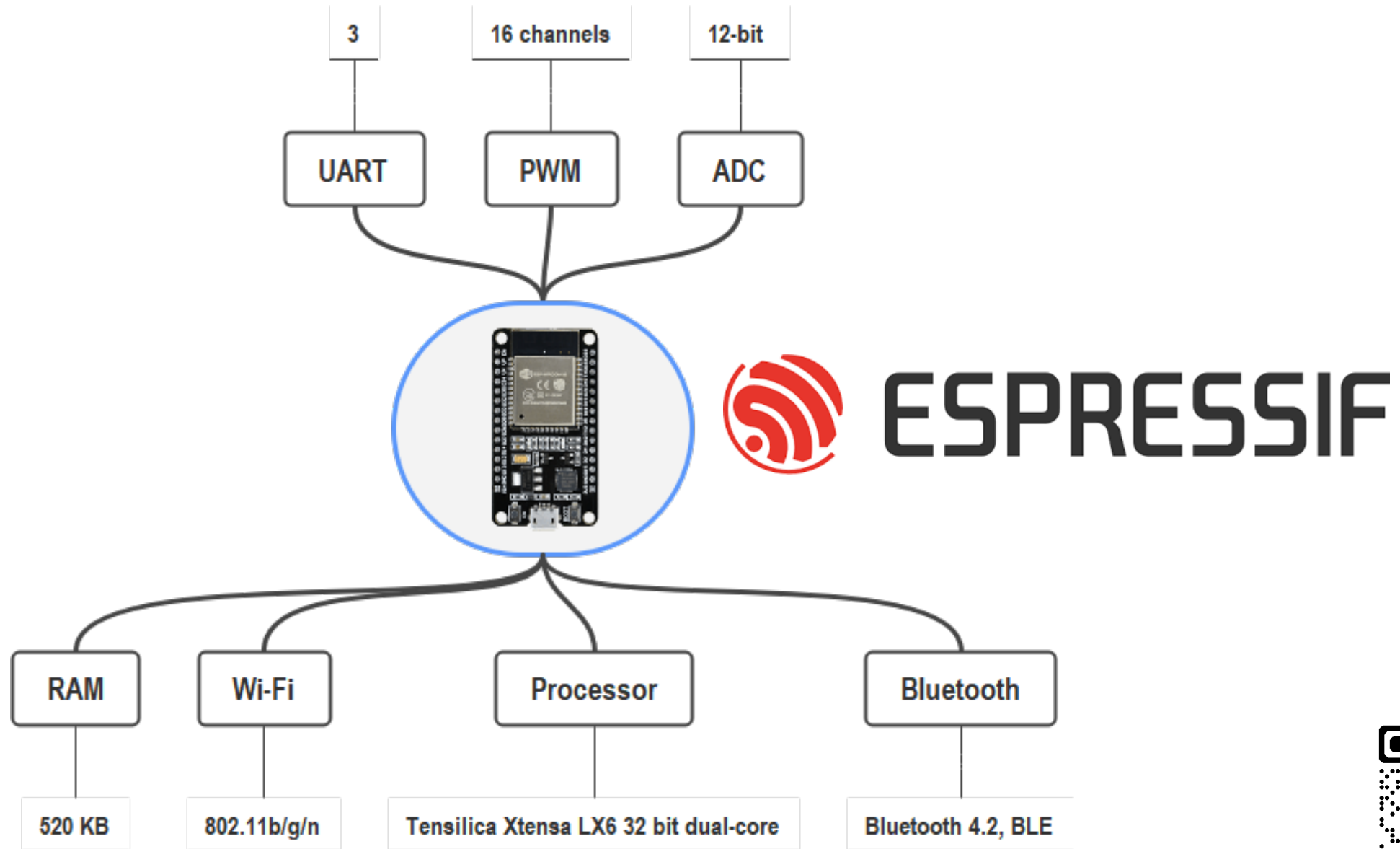
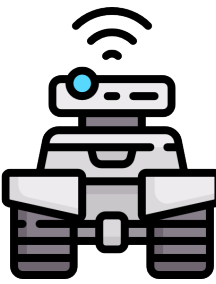
18650 Lithium Ion Battery



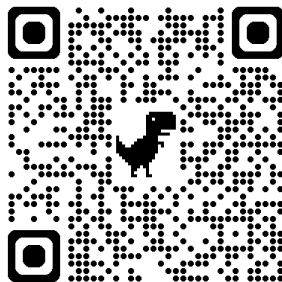
Motor Driver

Kendali Robot Car Berbasis ESP32 melalui Bluetooth

Mikrokontroler **ESP32**

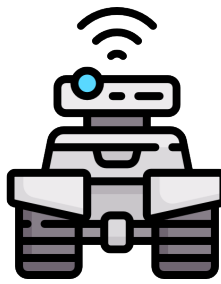


Reference



Kendali Robot Car Berbasis ESP32 melalui Bluetooth

Mikrokontroler **ESP32**



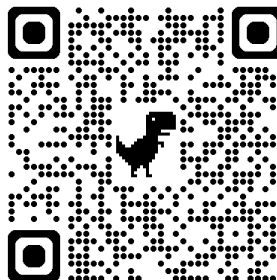
30 Pin



38 Pin

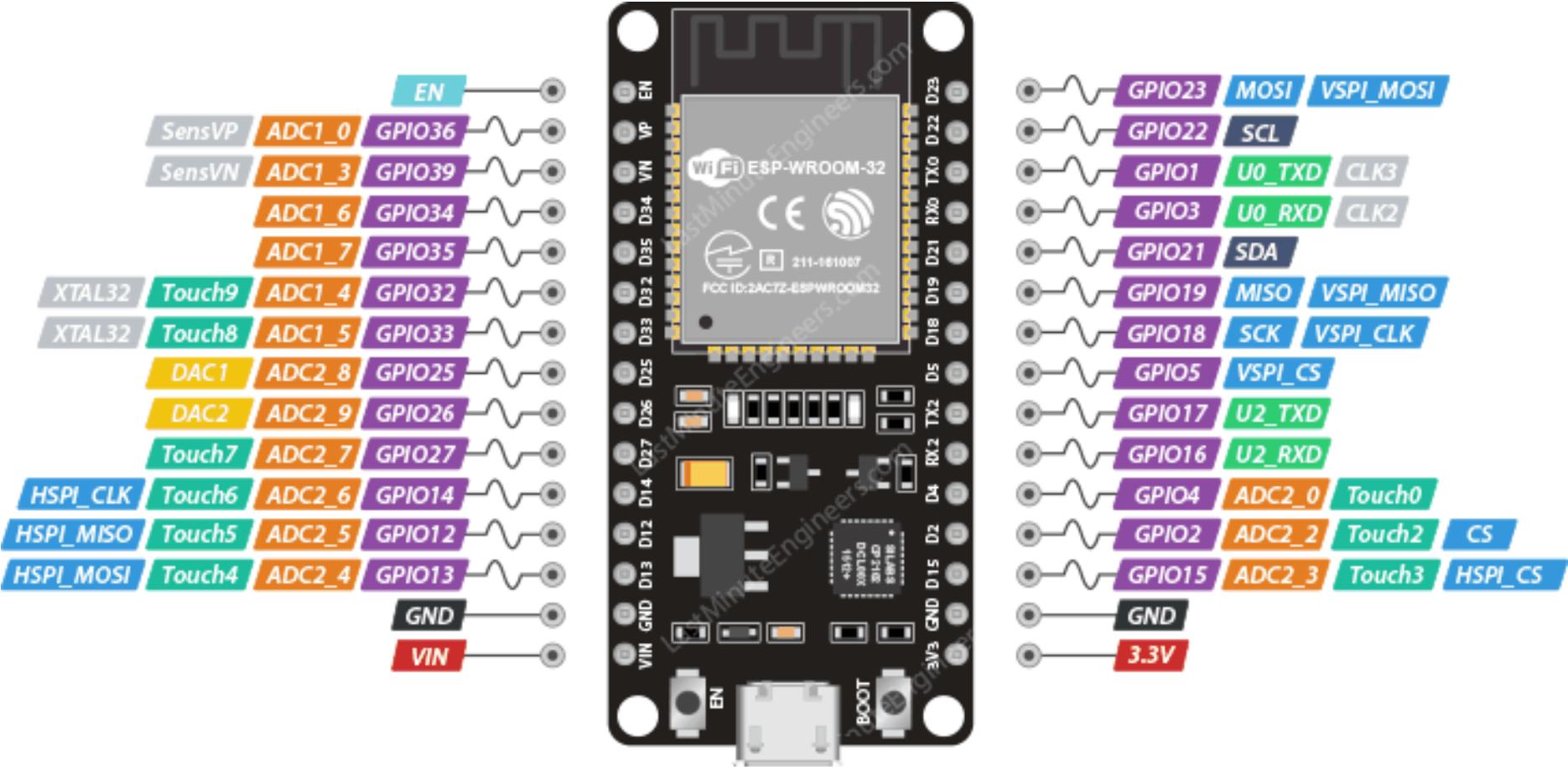
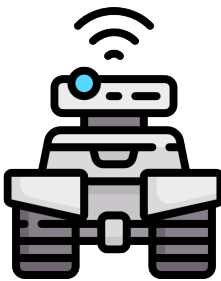


Reference



Kendali Robot Car Berbasis ESP32 melalui Bluetooth

Mikrokontroler ESP32 30 Pinout



Power

GND

EN

GPIO

SPI

I2C

ADC

DAC

Touch

UART

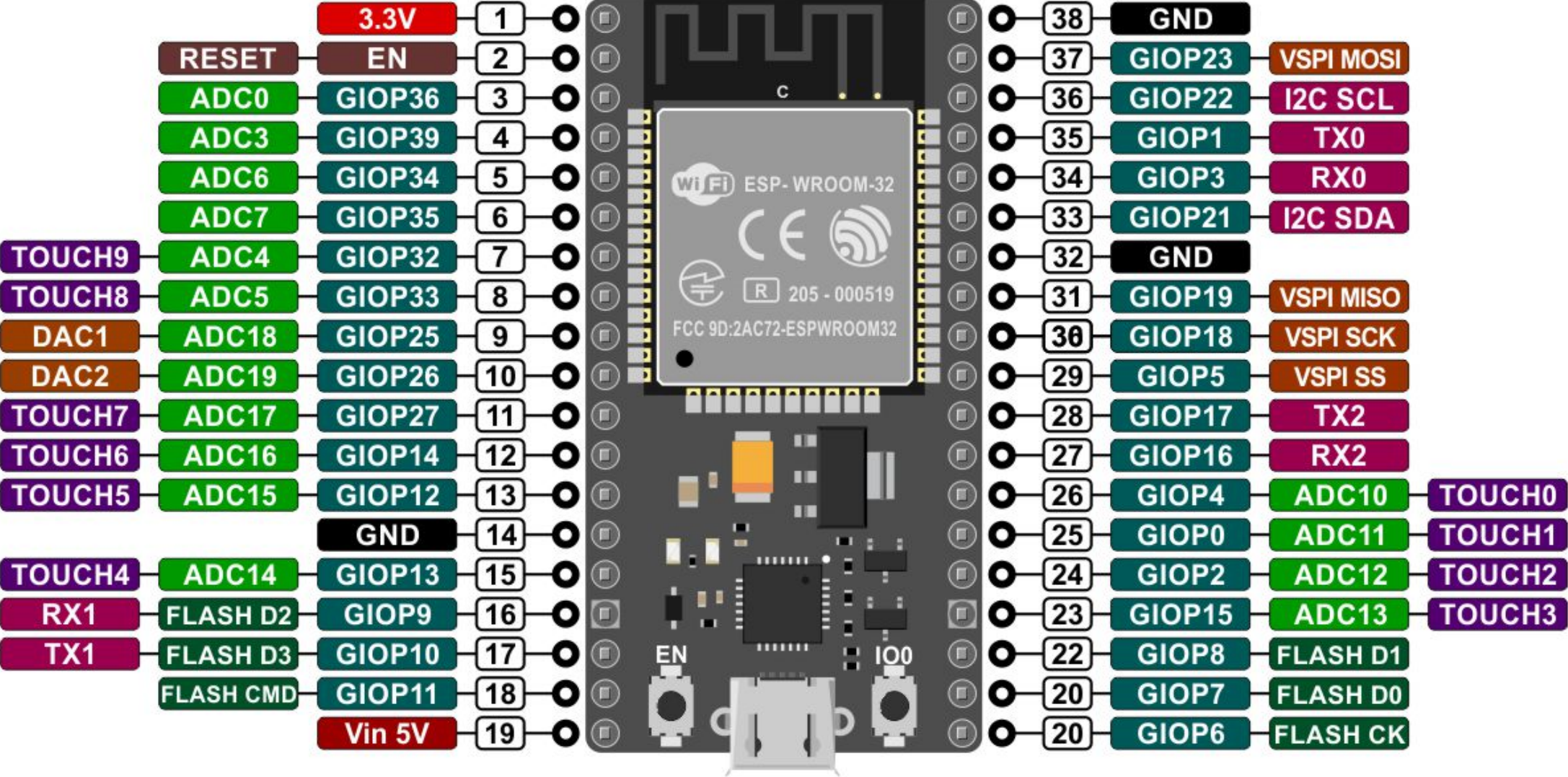
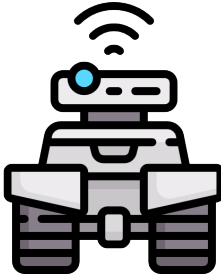
Control

PWM

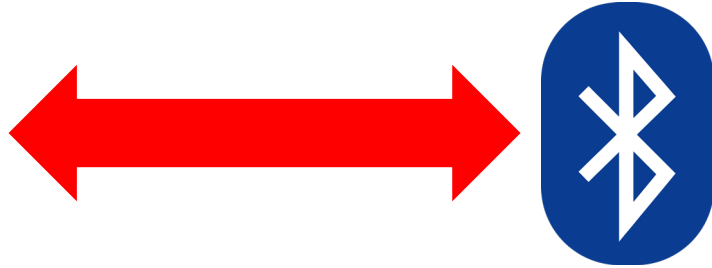
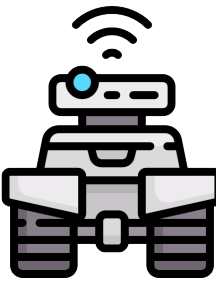
Kendali Robot Car Berbasis ESP32 melalui Bluetooth

Reference

Mikrokontroler ESP32 38 pinout



Bluetooth on ESP32



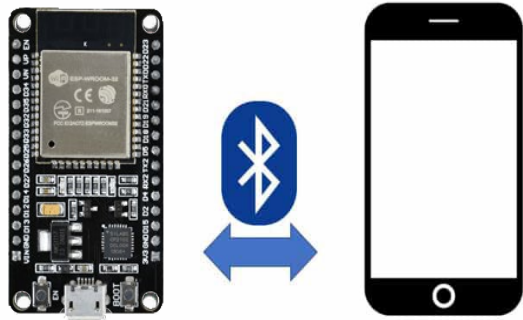
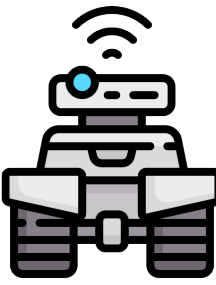
- ❖ Bluetooth Classic = koneksi stabil untuk kendali & streaming data (`#include "BluetoothSerial.h"`).
- ❖ BLE (Bluetooth Low Energy) = koneksi hemat daya untuk sensor & IoT ringan (`#include "BLEDevice.h"`).

Reference



Kendali Robot Car Berbasis ESP32 melalui Bluetooth

Example



```
#include "BluetoothSerial.h"

BluetoothSerial SerialBT;

void setup() {
  Serial.begin(115200);
  SerialBT.begin("ESP32_Robot"); // Nama Bluetooth yang akan
  muncul di HP
  Serial.println("Bluetooth siap! Pair dengan ESP32_Robot");
}

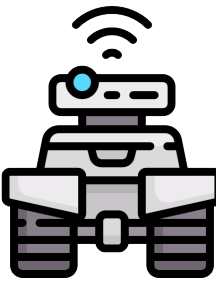
void loop() {
  if (SerialBT.available()) {
    char data = SerialBT.read();
    Serial.println(data); // Tampilkan di serial monitor

    // Contoh kontrol sederhana
    if (data == 'F') Serial.println("MAJU");
    if (data == 'B') Serial.println("MUNDUR");
  }
}
```

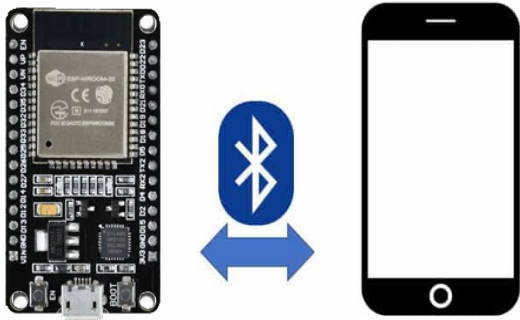
Reference



Example



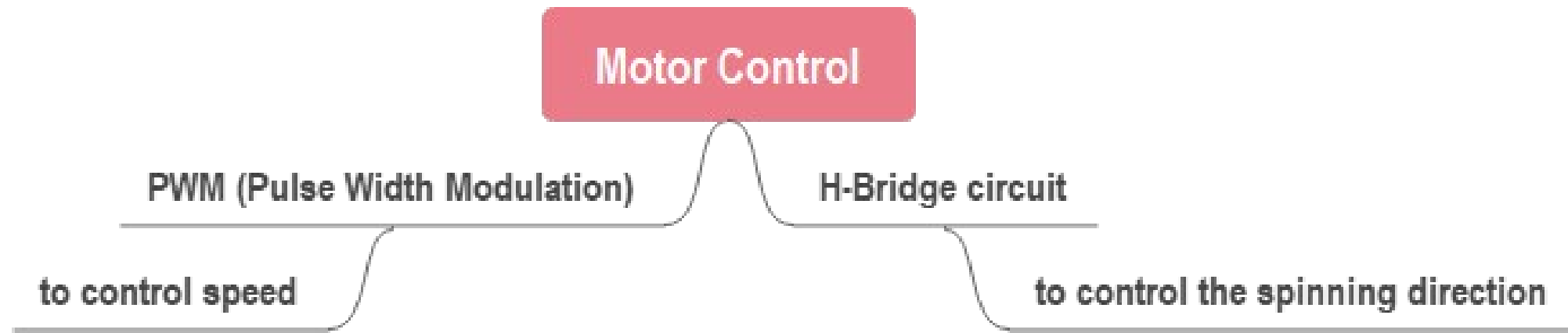
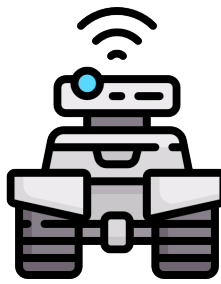
```
void handleMovement(char cmd) {  
    switch (cmd) {  
        case 'F': forward(); break;  
        case 'B': backward(); break;  
        case 'L': left(); break;  
        case 'R': right(); break;  
        case 'S': stopCar(); break;  
        default: stopCar(); break;  
    }  
}
```



Reference

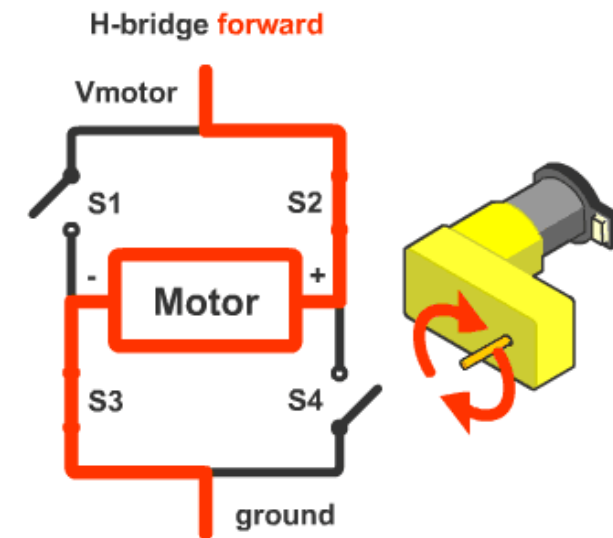
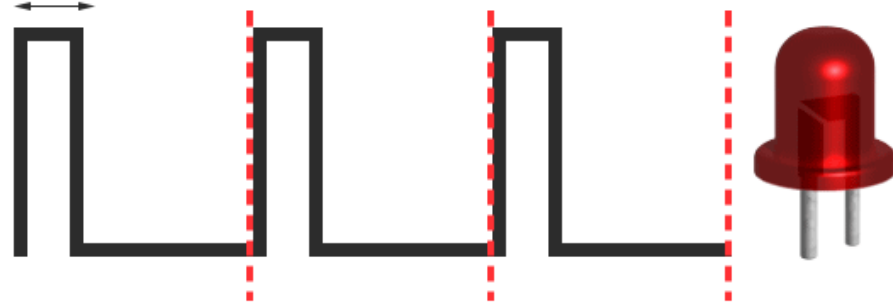


Understanding Motor Control Basics

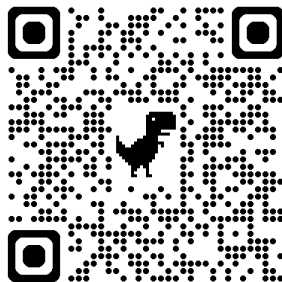


VOLTAGE

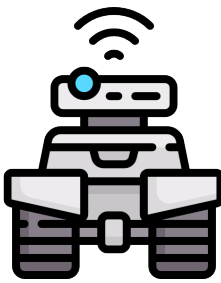
20%
DUTY CYCLE



Reference



To control the spinning direction



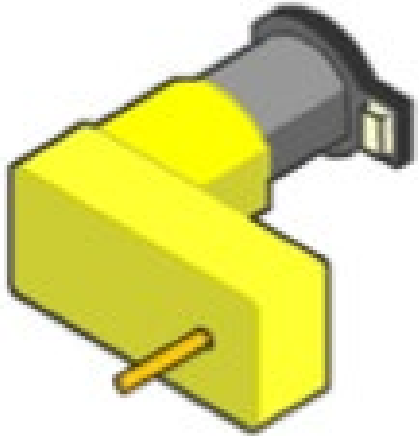
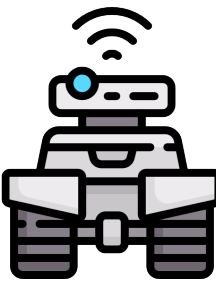
Fungsi	Pin ESP32	Keterangan
ENA	GPIO 14	Enable motor kiri (PWM speed control)
IN1	GPIO 27	Motor kiri – maju
IN2	GPIO 26	Motor kiri – mundur
IN3	GPIO 25	Motor kanan – maju
IN4	GPIO 33	Motor kanan – mundur
ENB	GPIO 32	Enable motor kanan (PWM speed control)

```
// ===== Pin Motor ===== // ===== LEDC (PWM) Settings =====
#define ENA 14                      #define PWM_FREQ 5000           // 5 kHz PWM
#define IN1 27                      frequency
#define IN2 26                      #define PWM_RES 8             // 8-bit
#define IN3 25                      resolution (0-255)
#define IN4 33                      #define PWM_CHANNEL_A 0
#define ENB 32                      #define PWM_CHANNEL_B 1
```

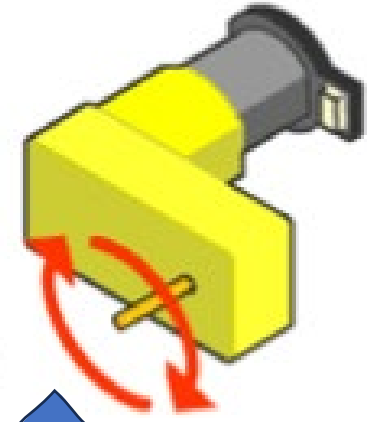
Reference



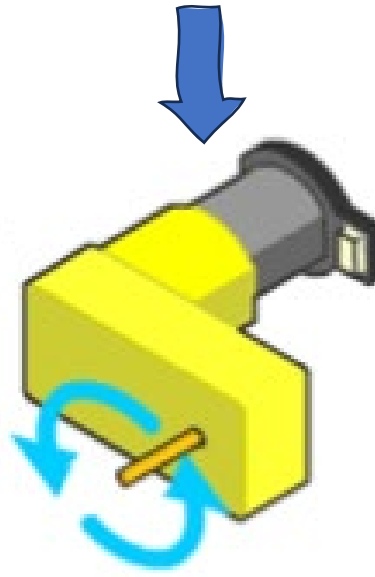
To control the spinning direction



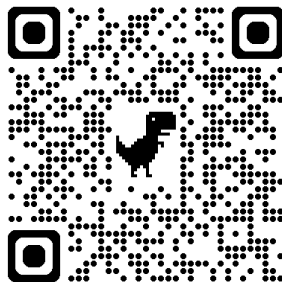
```
void backward() {  
    ledcWriteChannel(PWM_CHANNEL_A, speedMotor);  
    ledcWriteChannel(PWM_CHANNEL_B, speedMotor);  
    digitalWrite(IN1, LOW);  
    digitalWrite(IN2, HIGH);  
    digitalWrite(IN3, LOW);  
    digitalWrite(IN4, HIGH);  
}
```



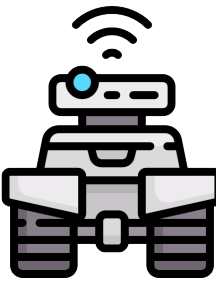
```
void forward() {  
    ledcWriteChannel(PWM_CHANNEL_A, speedMotor);  
    ledcWriteChannel(PWM_CHANNEL_B, speedMotor);  
    digitalWrite(IN1, HIGH);  
    digitalWrite(IN2, LOW);  
    digitalWrite(IN3, HIGH);  
    digitalWrite(IN4, LOW);  
}
```



Reference



To control **speed**

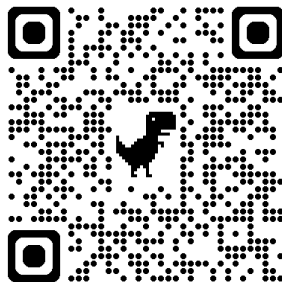


- PWM (***Pulse Width Modulation***) adalah Teknik untuk mengatur daya (atau kecepatan) dengan cara mengubah lebar pulsa sinyal digital.
- Jumlah tingkat (***step***) yang bisa digunakan untuk mengatur besar kecilnya sinyal PWM. Semakin tinggi resolusi, semakin halus pengaturan kecepatannya.
- Persentase waktu sinyal ***ON*** dalam satu siklus PWM. Semakin besar duty cycle, semakin besar daya atau kecepatan motor.

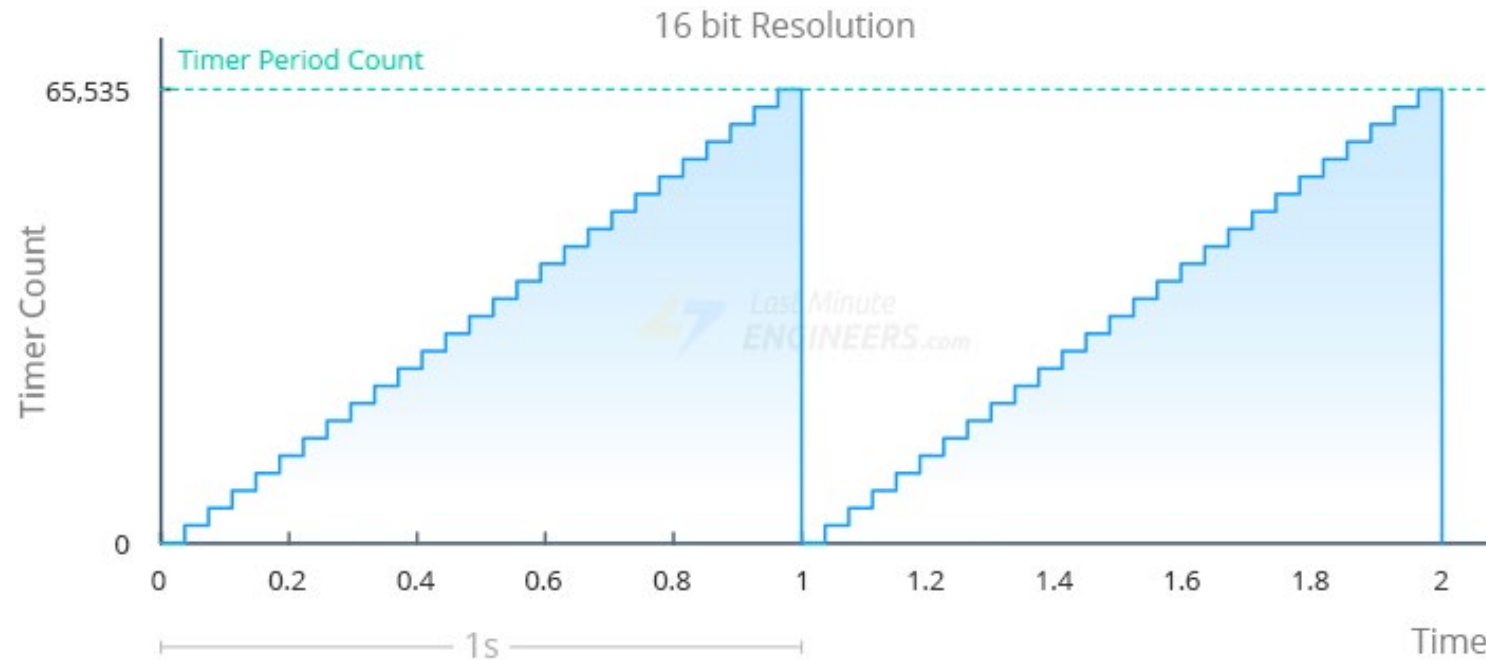
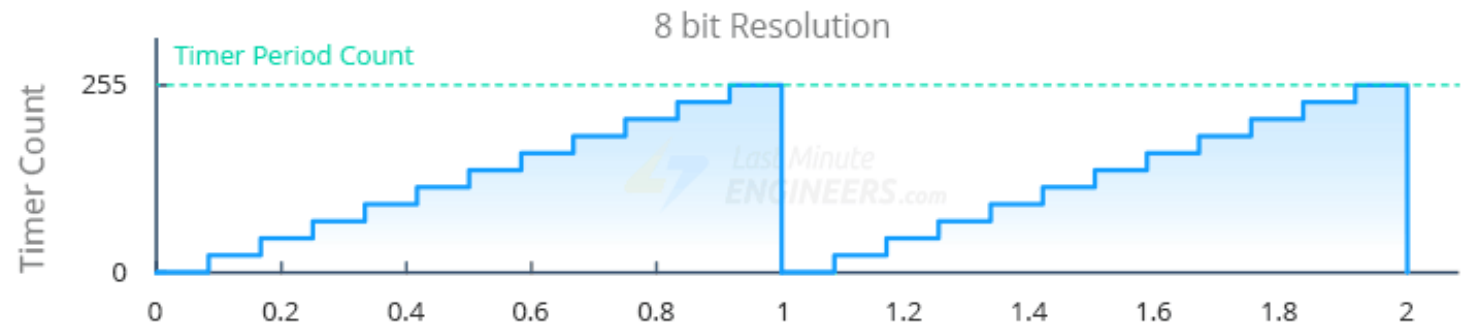
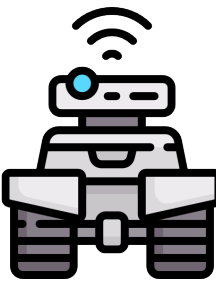
```
// === LEDC API in Setup ===
```

```
ledcAttachChannel(ENA, PWM_FREQ, PWM_RES, PWM_CHANNEL_A); // Motor kiri  
ledcAttachChannel(ENB, PWM_FREQ, PWM_RES, PWM_CHANNEL_B); // Motor kanan
```

Reference



PWM Resolution

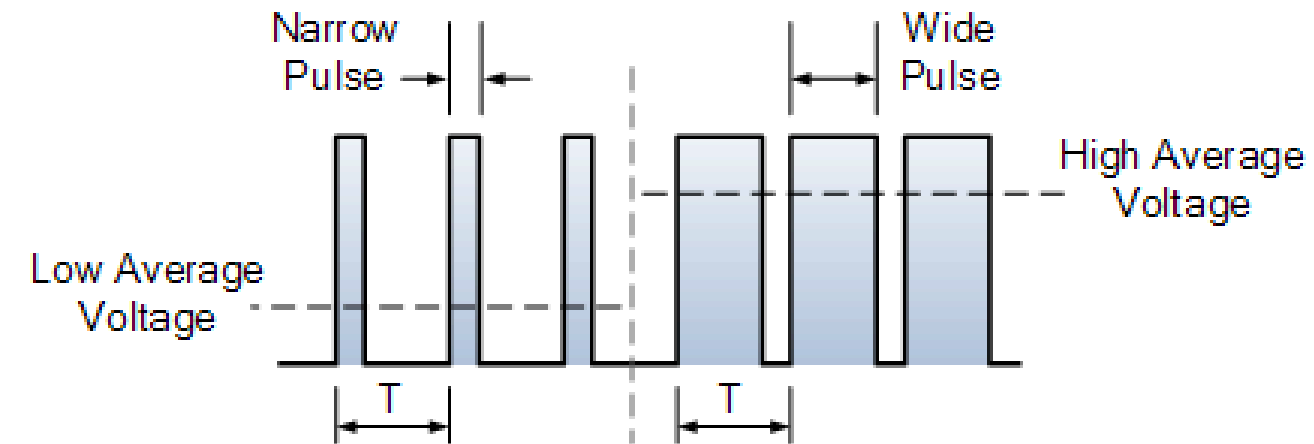
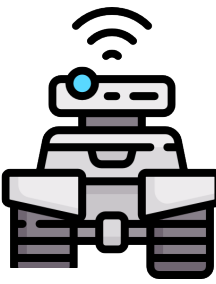


Reference



Kendali Robot Car Berbasis ESP32 melalui Bluetooth

Duty Cycle



50% duty cycle



75% duty cycle



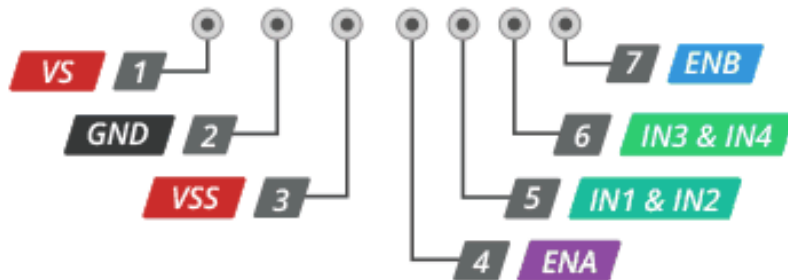
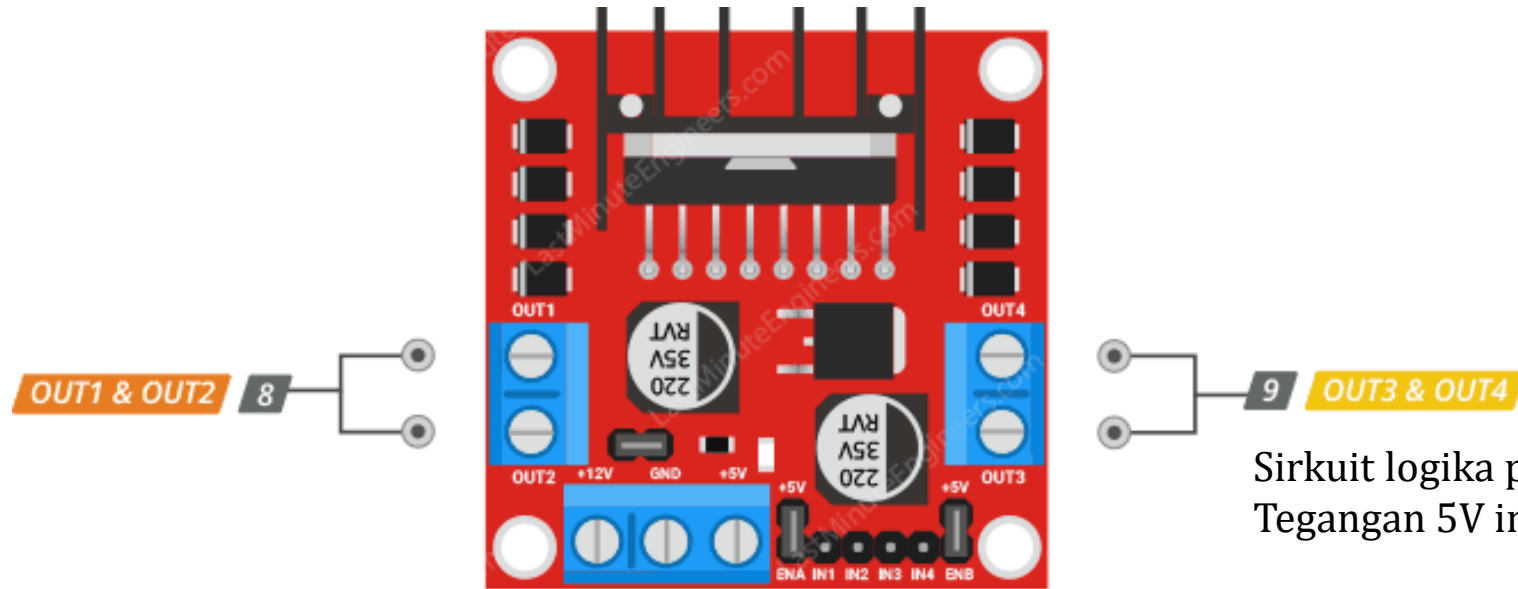
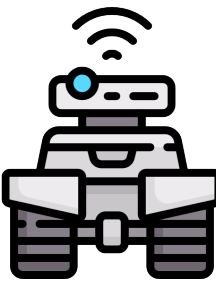
25% duty cycle



Reference



L298N Motor Driver

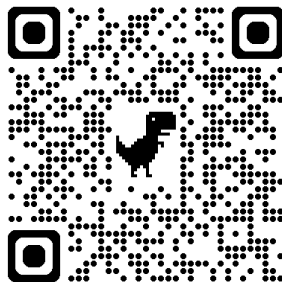


Sirkuit logika pada modul L298N memerlukan tegangan 5V. Tegangan 5V ini bisa diperoleh dengan dua cara:

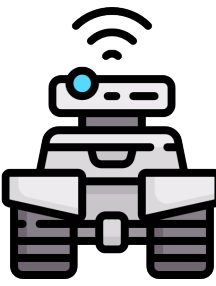
1. Memberi suplai eksternal 5V langsung ke pin VSS
2. Menggunakan regulator 5V bawaan modul, yang otomatis mengambil daya dari suplai motor (VS) dan menghasilkan 5V untuk sirkuit logika.

Jika kamu memakai regulator bawaan, tidak perlu lagi menyambungkan pin VSS ke sumber 5V eksternal.

Reference

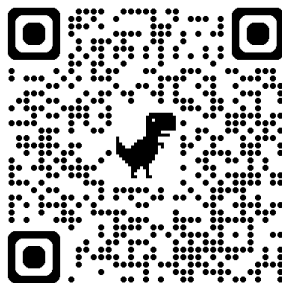


L298N Truth Table

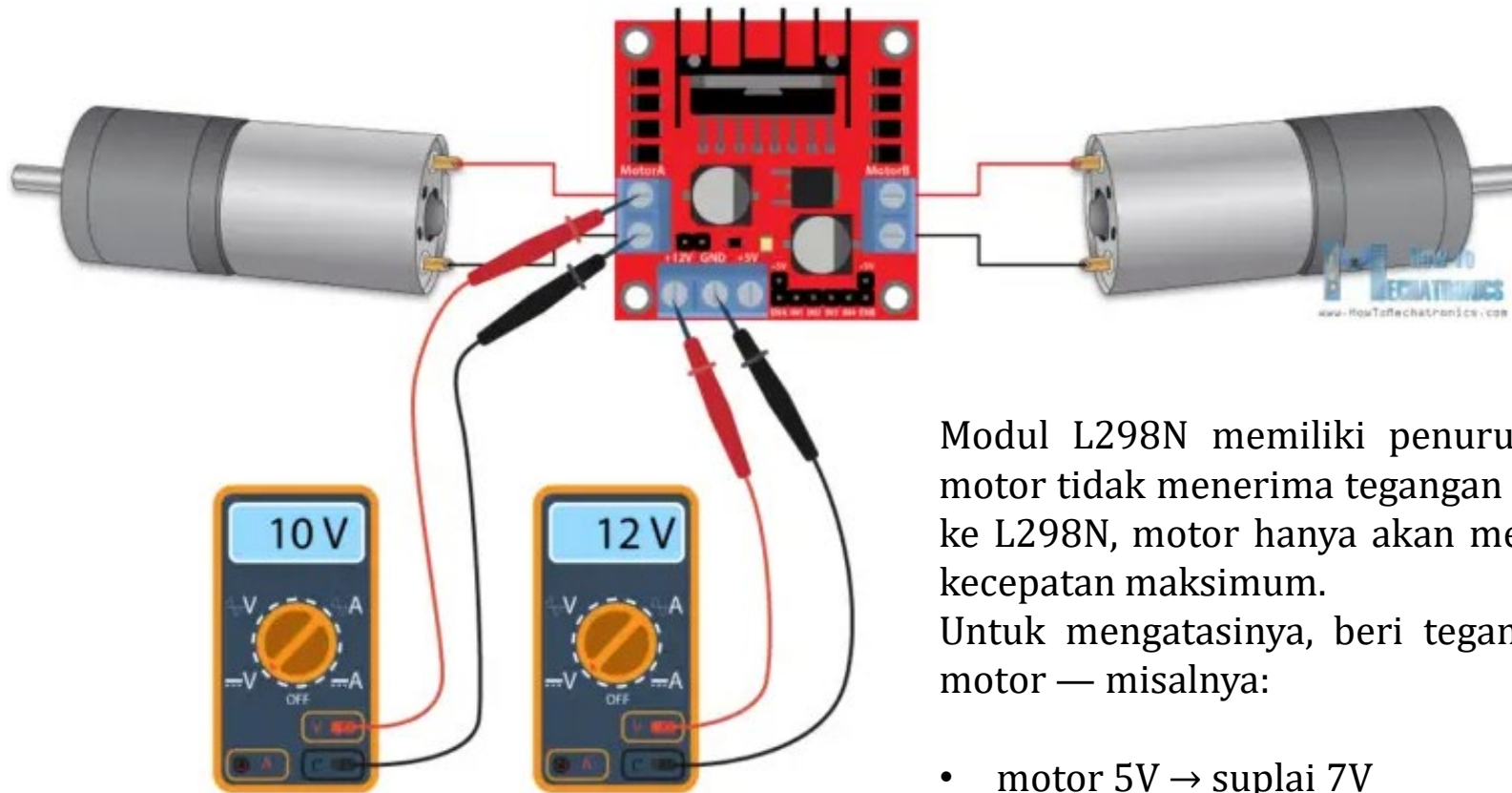
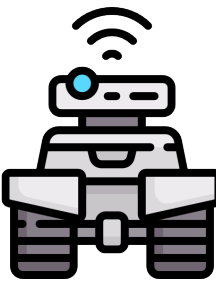


Input1	Input2	Spinning Direction
Low(0)	Low(0)	Motor OFF
High(1)	Low(0)	Forward
Low(0)	High(1)	Backward
High(1)	High(1)	Motor OFF

Reference



Voltage Drop of L298N

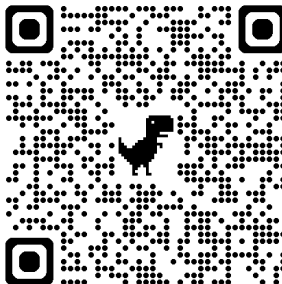


Modul L298N memiliki penurunan tegangan internal sekitar 2V, sehingga motor tidak menerima tegangan penuh dari sumber daya. Memberi suplai 12V ke L298N, motor hanya akan mendapat sekitar 10V dan tidak berputar pada kecepatan maksimum.

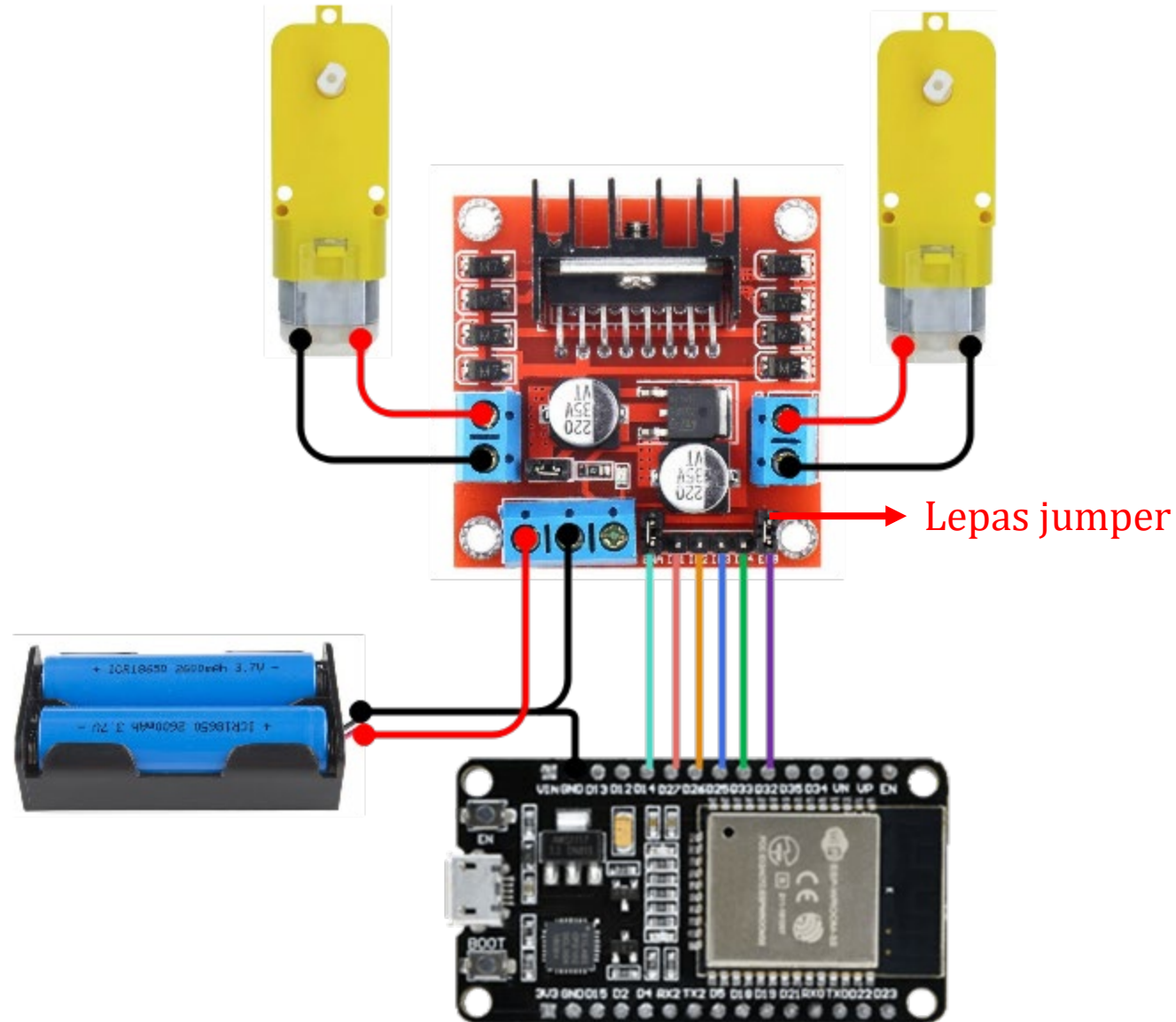
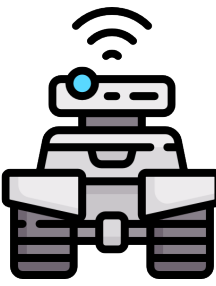
Untuk mengatasinya, beri tegangan sekitar 2V lebih tinggi dari kebutuhan motor — misalnya:

- motor 5V → suplai 7V
- motor 12V → suplai 14V

Reference

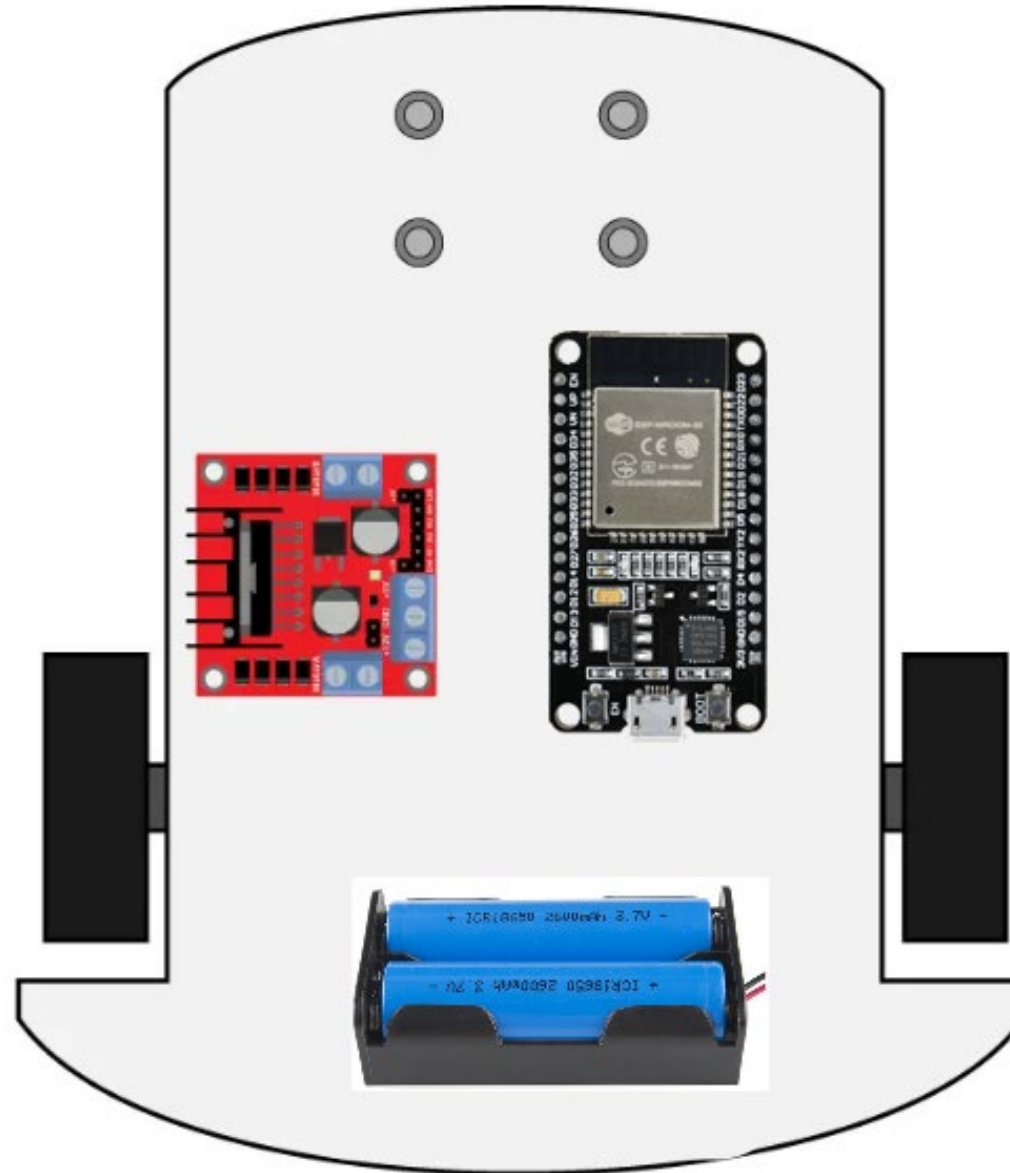
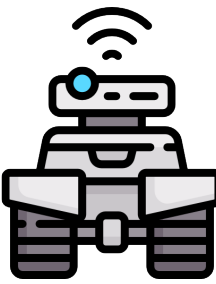


Wiring an L298N Driver Module to an ESP32



Kendali Robot Car Berbasis ESP32 melalui Bluetooth

Tata Letak Komponen



Reference



Kendali Robot Car Berbasis ESP32 melalui Bluetooth

