

A photograph of a red Citroën 2CV car parked on a street at dusk. The car is in the foreground, angled slightly towards the left. It has a black roof rack and a license plate that reads 'YD26 272'. In the background is a large, historic brick building with multiple arched windows. Some windows are illuminated from within, and a street lamp is visible. A person in a blue shirt is standing near one of the windows. The overall atmosphere is warm and nostalgic.

# ByteRider

## Version

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# ByteRider documentation

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# INTRODUCTION

# HOW DOES IT WORK?

The BitByteRider RC car is powered by ESP32-C3 Breadboard & Power adapter development board.

## Reserved Pins & GPIOs

The following table summarizes GPIOs and pins reserved for operations purposes.

The GPIO numbers correspond to those on the ESP32-C3 WROOM microcontroller. The Pin number corresponds to the pin on the Breadboard and Power adapter development board.

### x- and y- axis

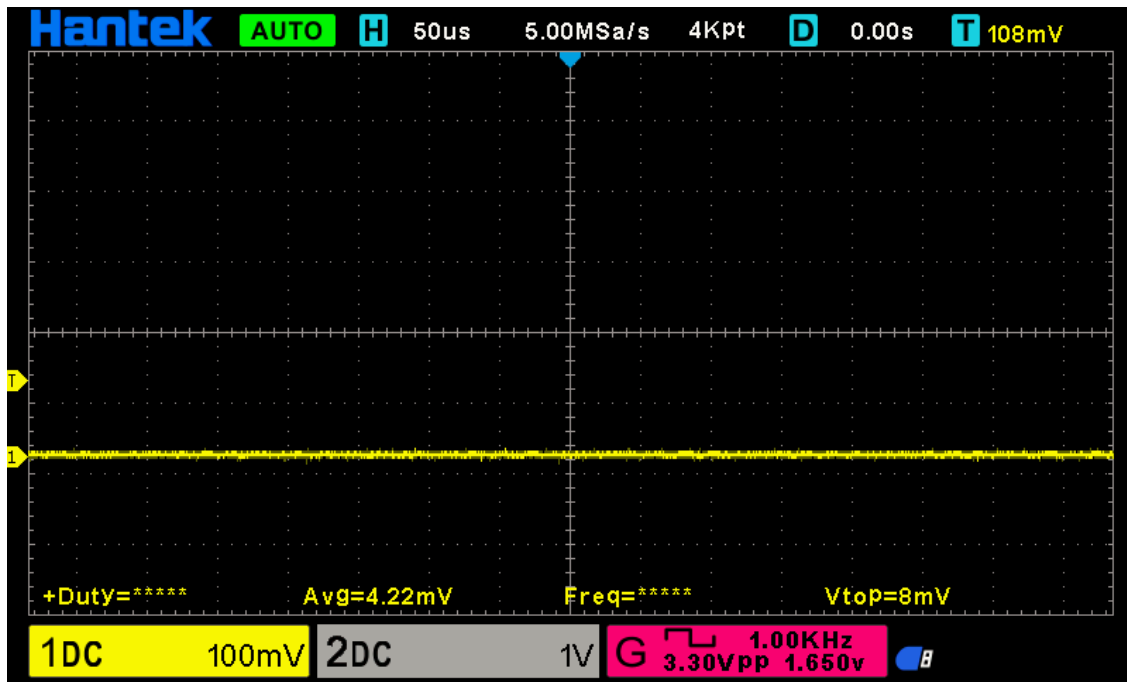
The **GPIO0** and **GPIO1** assigned to measuring the voltage of x- and y- axis of the Joystick. Lastly, there is a group of GPIO pairs responsible for PWM for DC motors.

### Direction and Speed

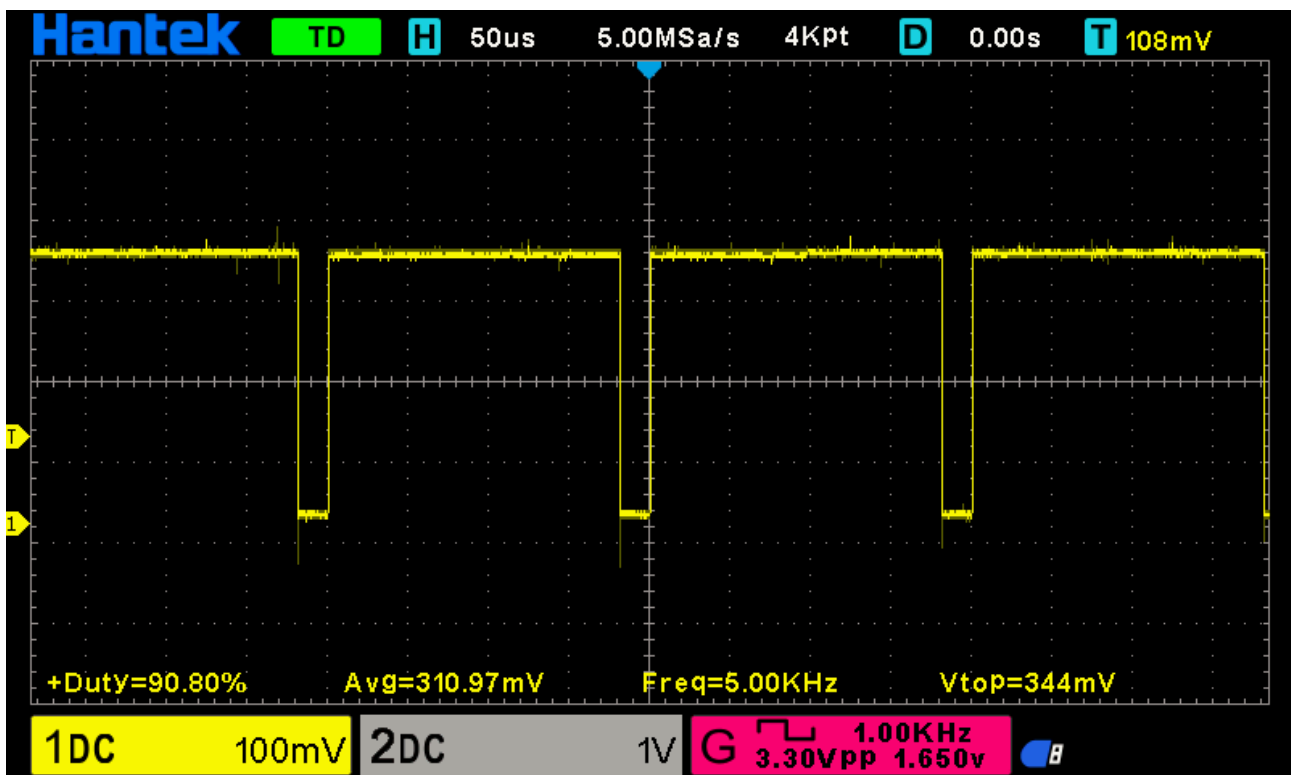
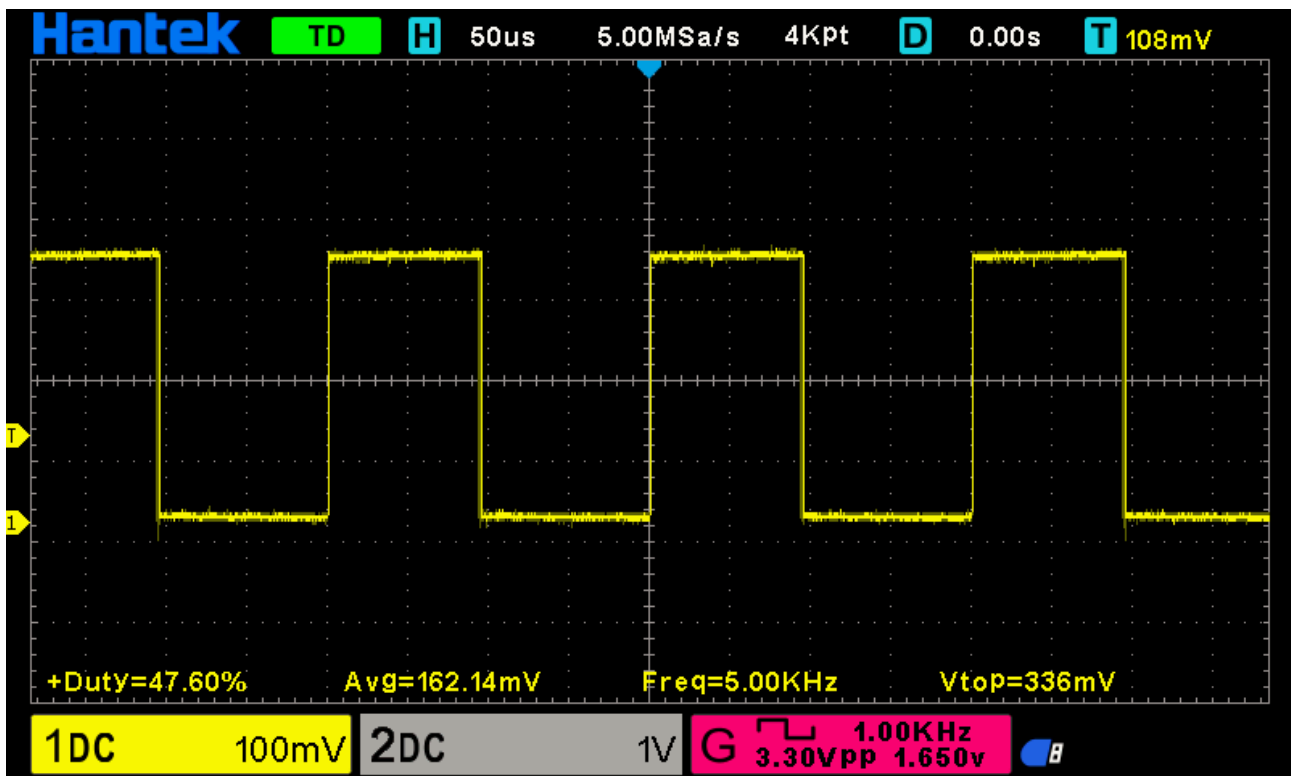
The pairs of DC motors on the left side are wired to the dedicated PWM channels. This means that *ESP32-C3 Breadboard DevBoard* can control rotation speed and direction of DC motors in pairs only (i.e. left and right side). Consequently, only four PWM channels are sufficient for controlling the direction of the RC car. Based on this constraint, the RC car can only move front, back, and turn/rotate left and right. Any other movements are not possible (i.e. diagonal or sideways).

A pair of PWM channels are required for defining rotation speed and direction of the DC motors on each side. In particular, **GPIO6** and **GPIO5** provide PWM to the left- and right- side DC motors to rotate in a **clockwise** direction. Similarly, **GPIO4** and **GPIO7** provide PWM to the left- and right- side DC motors to rotate in a **counter-clockwise** direction. Changing PWM on each channel determines the speed and direction of the RC car.

The following images illustrate various PWM duty cycles registered by oscilloscope (duty cycles 0%, 50% and 95%, resp.).



DC Motor PWM duty cycle 0%.



GPIO	Pin	Function	Notes
0	16	Joystick x-axis	ADC1_CH0
1	15	Joystick y-axis	ADC1_CH1
8	5	Joystick push button	
6	4	PWM for clockwise rotation of left-side motors	LEDC_CHANNEL_1
5	3	PWM for clockwise rotation of right-side motors	LEDC_CHANNEL_0
4	2	PWM for counter-clockwise rotation of right-side motors	LEDC_CHANNEL_2
7	6	PWM for counter-clockwise rotation of left-side motors	LEDC_CHANNEL_3

## Fusion of Software with Hardware

The *struct* for storing motors PWM values.

```
struct motors_rpm {
    int motor1_rpm_pwm;
    int motor2_rpm_pwm;
    int motor3_rpm_pwm;
    int motor4_rpm_pwm;
};
```

The function for updating motors' PWM values.

```
// Function to send data to the receiver
void sendData (void) {
    sensors_data_t buffer;           // Declare data struct

    buffer.crc = 0;
    buffer.x_axis = 0;
    buffer.y_axis = 0;
    buffer.nav_btn = 0;
```



```

    buffer.motor1_rpm_pwm = 0;
    buffer.motor2_rpm_pwm = 0;
    buffer.motor3_rpm_pwm = 0;
    buffer.motor4_rpm_pwm = 0;

    // Display brief summary of data being sent.
    ESP_LOGI(TAG, "Joystick (x,y) position ( 0x%04X, 0x%04X )",
(uint8_t)buffer.x_axis, (uint8_t)buffer.y_axis);
    ESP_LOGI(TAG, "pwm 1, pwm 2 [ 0x%04X, 0x%04X ]",
(uint8_t)buffer.pwm, (uint8_t)buffer.pwm);
    ESP_LOGI(TAG, "pwm 3, pwm 4 [ 0x%04X, 0x%04X ]",
(uint8_t)buffer.pwm, (uint8_t)buffer.pwm);

    // Call ESP-NOW function to send data (MAC address of receiver,
    pointer to the memory holding data & data length)
    uint8_t result = esp_now_send(receiver_mac, &buffer,
sizeof(buffer));

    // If status is NOT OK, display error message and error code (in
    hexadecimal).
    if (result != 0) {
        ESP_LOGE("ESP-NOW", "Error sending data! Error code:
0x%04X", result);
        deletePeer();
    }
    else
        ESP_LOGW("ESP-NOW", "Data was sent.");
}

```

The `onDataReceived()` and `onDataSent()` are two call-back functions that get evoked on each corresponding event.

The `rc_send_data_task()` function runs every 0.1 second to transmit the data to the receiver.

```

// Continuous, periodic task that sends data.
static void rc_send_data_task (void *arg) {

    while (true) {
        if (esp_now_is_peer_exist(receiver_mac))
            sendData();
        vTaskDelay (100 / portTICK_PERIOD_MS);
    }
}

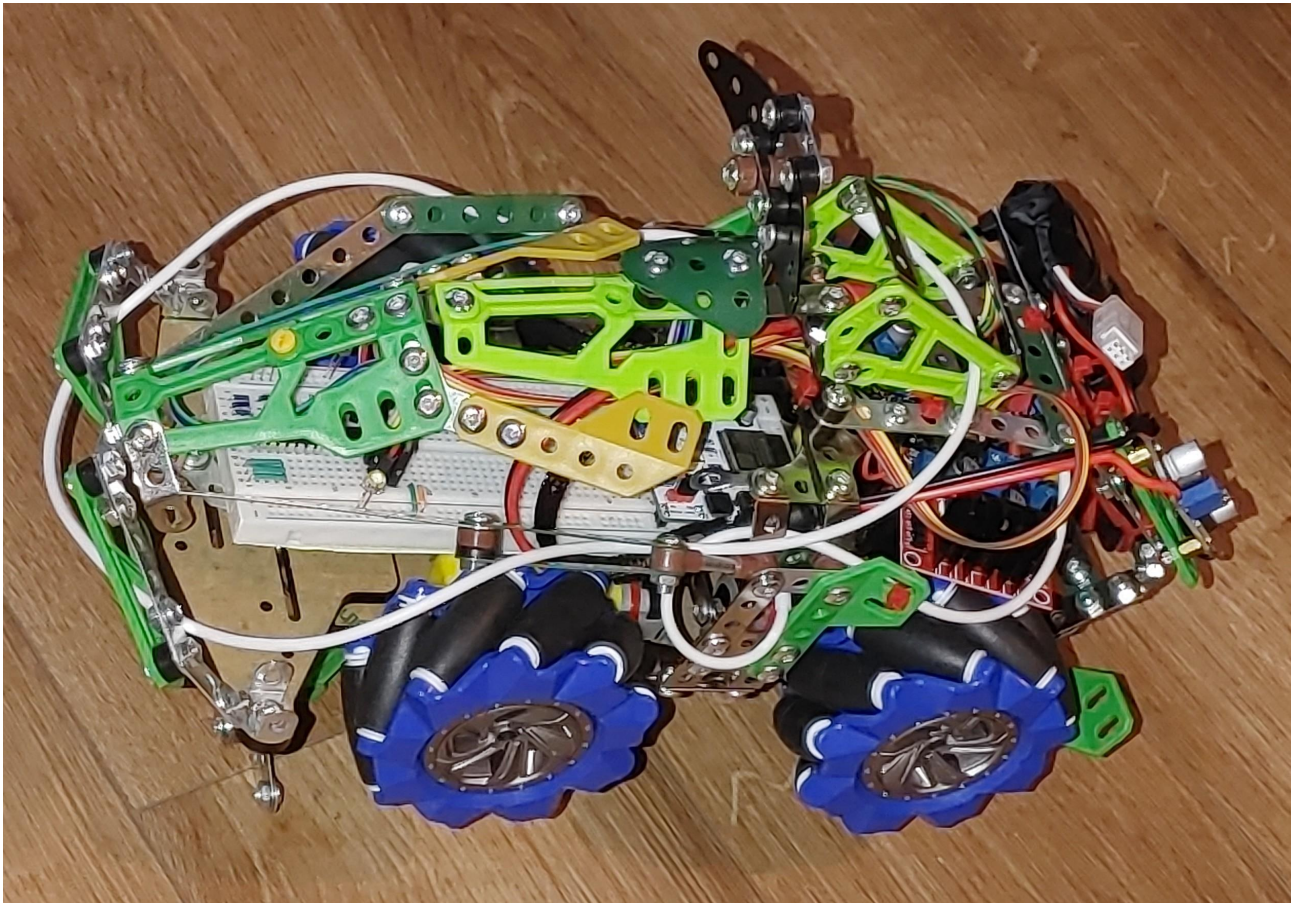
```

# Schematic



# WORK-IN-PROGRESS WALK THROUGH

## Finished Work



## Chassis



Completed chassis with only DC motor controllers installed.



## Wiring



Completed wiring.

## Motor Wires Harness



DC Motors wires secured inside harness.



