MSPM0 road sign indication action

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The relationship between the 4 motor interfaces and the car is as follows:
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1. Opening instructions

Please read the "Motor Introduction and Usage" in the four-way motor driver board information first to understand the motor parameters, wiring method, and power supply voltage you are currently using. To avoid burning the motherboard or motor.

Motor: The case and code take the 520L motor of our store as an example.

2. Experimental preparation

The relationship between the 4 motor interfaces and the car is as follows:

M1 -> upper left motor (left front wheel of the car)

M2 -> lower left motor (left rear wheel of the car)

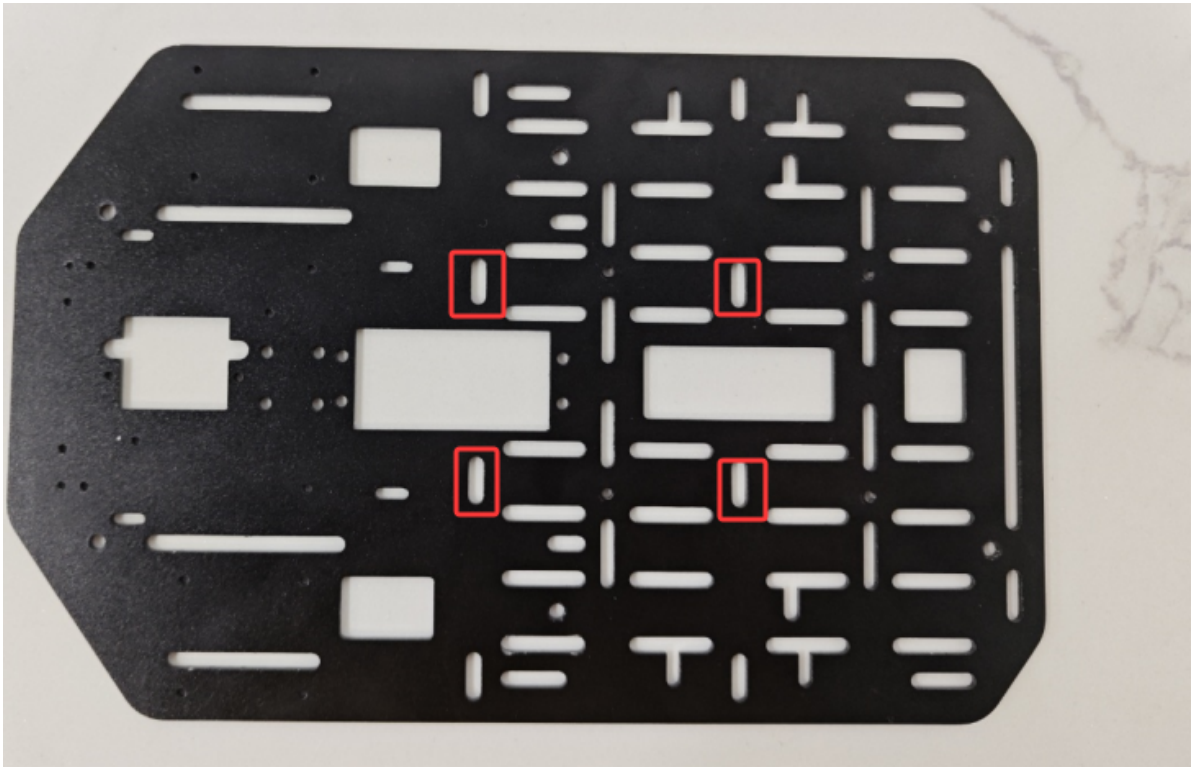
M3 -> upper right motor (right front wheel of the car)

M4 -> lower right motor (right rear wheel of the car)

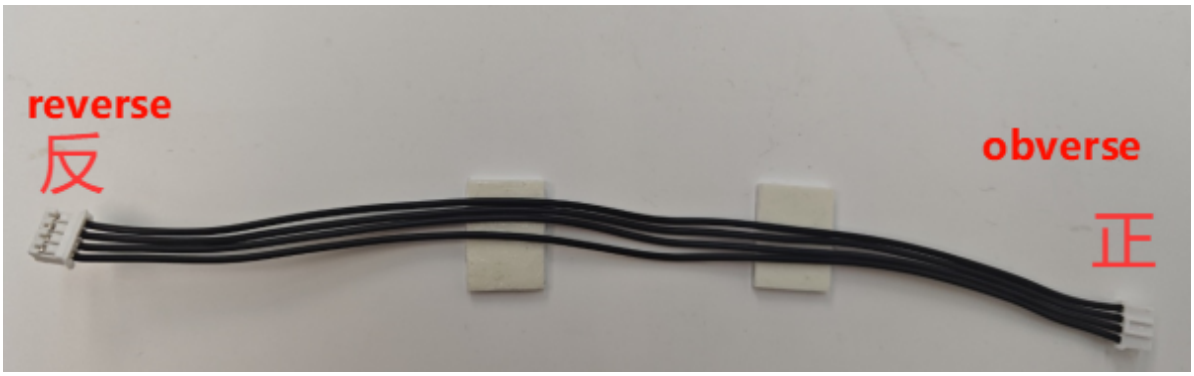
Hardware wiring

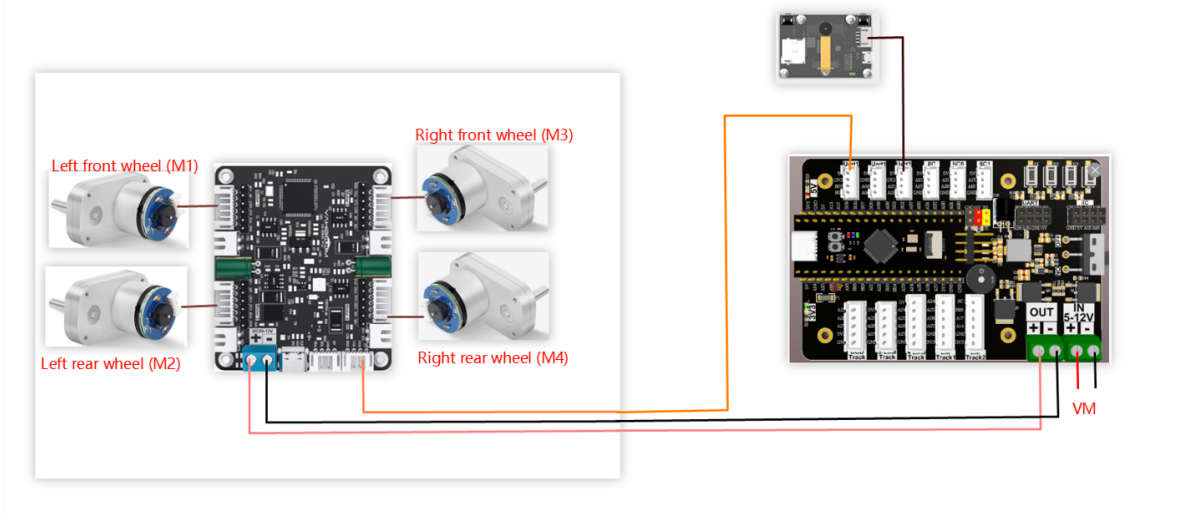
Wiring using MSPM0 robot expansion board

During the installation and wiring process, if the wiring length is not enough, you can move the MSPM0 robot expansion board forward a little and install it, as shown in the following figure.

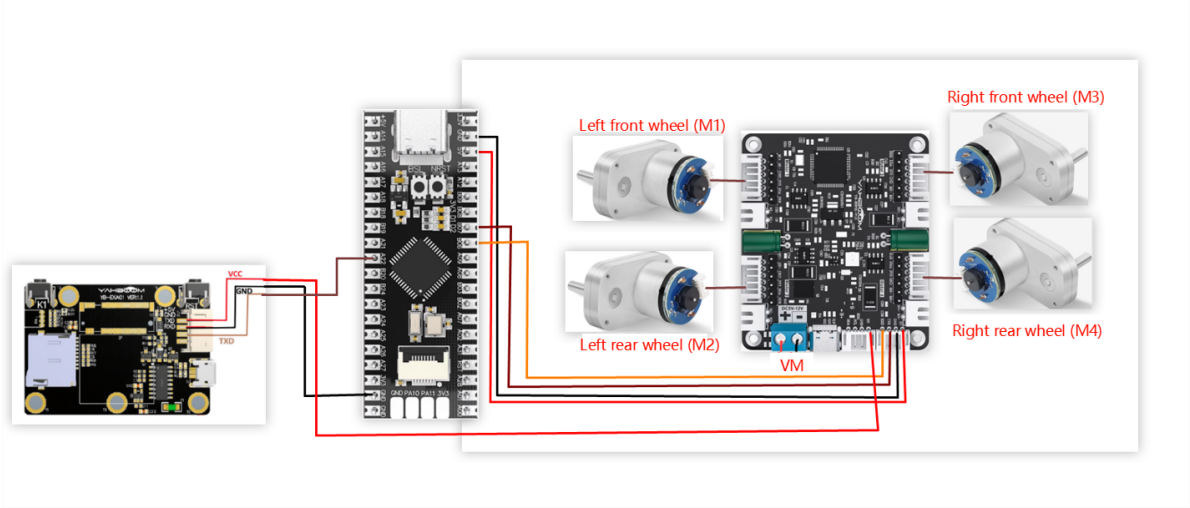


Note: The wire used for the k210 vision module and the wire used to connect the MSPM0 robot expansion board and the four-way motor driver module are: PH2.0-4pin cable, double-ended all black, reverse (200mm), the direction of the reverse cable holder is shown in the following figure





Wiring using MSPM0G3507 core board (Yahboom)



Wiring pins

Four-way motor driver board	MSPM0G3507 core board (Yahboom)
RX2	PB6
TX2	PB7
GND	GND
5V	5V

Take M1 motor as an example below, and other motors are similar

Motor	Four-way motor driver board (Motor)
M+	M1+
M-	M1-
GND	GND
VCC	3V3
B	H1A
A	H1B

K210 vision module	MSPM0G3507 core board (Yahboom)
5V	5V
GND	GND
TXD	PA22
RXD	PA21

3. Key code analysis

- revaction.c

```
// 获取命令标志   Get command flag
uint8_t Get_CMD_Flag(void)
{
    return New_CMD_flag;
}

// 清除命令数据和相关标志  Clear command data and related flags
void Clear_CMD_Flag(void)
{
    #if ENABLE_CLEAR_RXBUF
    for (uint8_t i = 0; i < New_CMD_length; i++)
    {
        RxBuffer[i] = 0;
    }
    #endif
    New_CMD_length = 0;
    New_CMD_flag = 0;
}
//数据分析  data analysis
void Upper_Data_Parse(uint8_t *data_buf, uint8_t num)
{
    uint8_t func_id = *(data_buf + 3);
    switch (func_id)
    {
    /* 判断功能字：小车速度设置 Judgment function word: Trolley speed setting */
    case FUNC_MOTION:
    {
        uint8_t parm = (uint8_t) *(data_buf + 4);
        int16_t Vx_recv = *(data_buf + 6) << 8 | *(data_buf + 5);
        int16_t Vy_recv = *(data_buf + 8) << 8 | *(data_buf + 7);
        int16_t Vz_recv = *(data_buf + 10) << 8 | *(data_buf + 9);
        uint8_t adjust = parm & 0x80;

        if (Vx_recv == 0 && Vy_recv == 0 && Vz_recv == 0)
        {
            Contrl_Pwm(0,0,0,0);
        }
        else
        {
            Motion_Car_Control(Vx_recv, Vy_recv, Vz_recv, (adjust==0?0:1));
        }
        break;
    }

    /* 判断功能字：彩灯控制 Judgment function word: color light control */
    case FUNC_RGB:
    {
        u8 index = *(data_buf + 4);
        u8 red = *(data_buf + 5);
        u8 green = *(data_buf + 6);
        u8 blue = *(data_buf + 7);
//        printf("RED:%d, G:%d, B:%d\r\n",red,green,blue);
        RGB_Set_Color(index, red, green, blue);
        RGB_Update();
        break;
```

```
    }

    default:
        break;
    }
}



//数据接收并保存   Data received and saved
void Upper_Data_Receive(uint8_t Rx_Temp)
{
    switch (RxFlag)
    {
    case 0:
        if (Rx_Temp == PTO_HEAD)
        {
            RxBuffer[0] = PTO_HEAD;
            RxFlag = 1;
        }
        break;

    case 1:
        if (Rx_Temp == PTO_DEVICE_ID)
        {
            RxBuffer[1] = PTO_DEVICE_ID;
            RxFlag = 2;
            RxIndex = 2;
        }
        else
        {
            RxFlag = 0;
            RxBuffer[0] = 0x0;
        }
        break;

    case 2:
        New_CMD_length = Rx_Temp + 2;
        if (New_CMD_length >= PTO_MAX_BUF_LEN)
        {
            RxIndex = 0;
            RxFlag = 0;
            RxBuffer[0] = 0;
            RxBuffer[1] = 0;
            New_CMD_length = 0;
            break;
        }
        RxBuffer[RxIndex] = Rx_Temp;
        RxIndex++;
        RxFlag = 3;
        break;

    case 3:
        RxBuffer[RxIndex] = Rx_Temp;
        RxIndex++;
        if (RxIndex >= New_CMD_length)
        {
            New_CMD_flag = 1;
```

```
            RxIndex = 0;
            RxFlag = 0;
        }
        break;

    default:
        break;
    }
}
```

Get_CMD_Flag: Get the k210 data flag

Clear_CMD_Flag: Clear command data and related flags

Upper_Data_Parse: Parse the saved k210 data and determine the function of k210

Upper_Data_Receive: Save the received k210 data

- app_motor.c

```
// 返回当前小车轮子轴间距和的一半  Returns half of the sum of the axle spacings of the current trolley wheels.
static float Motion_Get_APB(void)
{
    return Car_APB;
}
void Set_Motor(int MOTOR_TYPE)
{
    if(MOTOR_TYPE == 1)
    {
        send_motor_type(1);//配置电机类型 Configure motor type
        delay_ms(100);
        send_pulse_phase(30);//配置减速比 查电机手册得出    Configure the reduction ratio. Check the motor manual to find out
        delay_ms(100);
        send_pulse_line(11);//配置磁环线 查电机手册得出 Configure the magnetic ring wire. Check the motor manual to get the result.
        delay_ms(100);
        send_wheel_diameter(67.00);//配置轮子直径,测量得出        Configure the wheel diameter and measure it
        delay_ms(100);
        send_motor_deadzone(1900);//配置电机死区,实验得出 Configure the motor dead zone, and the experiment shows
        delay_ms(100);
    }

    ...

    else if(MOTOR_TYPE == 5)
    {
        send_motor_type(1);
        delay_ms(100);
        send_pulse_phase(40);
        delay_ms(100);
        send_pulse_line(11);
        delay_ms(100);
        send_wheel_diameter(67.00);
        delay_ms(100);
```

```
        send_motor_deadzone(1900);
        delay_ms(100);
    }
}
void Motion_Car_Control(int16_t V_x, int16_t V_y, int16_t V_z, uint8_t adjust)
{
    float robot_APB = Motion_Get_APB();
    speed_lr = 0;
    speed_fb = V_x;
    speed_spin = (V_z / 1000.0f) * robot_APB;
    if (V_x == 0 && V_y == 0 && V_z == 0)
    {
        Contrl_Speed(0,0,0,0);
        return;
    }

    speed_L1_setup = speed_fb - speed_spin;
    speed_L2_setup = speed_fb - speed_spin;
    speed_R1_setup = speed_fb  + speed_spin;
    speed_R2_setup = speed_fb  + speed_spin;

    if (speed_L1_setup > 1000) speed_L1_setup = 1000;
    if (speed_L1_setup < -1000) speed_L1_setup = -1000;
    if (speed_L2_setup > 1000) speed_L2_setup = 1000;
    if (speed_L2_setup < -1000) speed_L2_setup = -1000;
    if (speed_R1_setup > 1000) speed_R1_setup = 1000;
    if (speed_R1_setup < -1000) speed_R1_setup = -1000;
    if (speed_R2_setup > 1000) speed_R2_setup = 1000;
    if (speed_R2_setup < -1000) speed_R2_setup = -1000;

//
printf("%d\t,%d\t,%d\t,%d\r\n",speed_L1_setup,speed_L2_setup,speed_R1_setup,spee
d_R2_setup);

    Contrl_Speed(speed_L1_setup, speed_L2_setup, speed_R1_setup,
speed_R2_setup);

}
```

Motion_Get_APB: Returns half of the current wheel axle spacing of the car

Set_Motor: Sets the motor type of the four-way motor driver board, and changes the motor type according to your actual situation

Motion_Car_Control: Controls the different motion states of the car

- app_motor_usart.c

```
//发送电机类型    Transmitter motor type
void send_motor_type(motor_type_t data)
{
    sprintf((char*)send_buff,"$mtype:%d#",data);
    Send_Motor_ArrayU8(send_buff, strlen((char*)send_buff));

}

//发送电机死区    Send motor dead zone
```

```
void send_motor_deadzone(uint16_t data)
{
    sprintf((char*)send_buff,"$deadzone:%d#",data);
    Send_Motor_ArrayU8(send_buff, strlen((char*)send_buff));
}

//发送电机磁环脉冲  Send motor magnetic ring pulse
void send_pulse_line(uint16_t data)
{
    sprintf((char*)send_buff,"$mline:%d#",data);
    Send_Motor_ArrayU8(send_buff, strlen((char*)send_buff));
}

//发送电机减速比   Transmitting motor reduction ratio
void send_pulse_phase(uint16_t data)
{
    sprintf((char*)send_buff,"$mphase:%d#",data);
    Send_Motor_ArrayU8(send_buff, strlen((char*)send_buff));
}

//发送轮子直径    Send wheel diameter
void send_wheel_diameter(float data)
{
    sprintf((char*)send_buff,"$wdiameter:%.3f#",data);
    Send_Motor_ArrayU8(send_buff, strlen((char*)send_buff));
 }
//控制速度  Controlling Speed
void Contrl_Speed(int16_t M1_speed,int16_t M2_speed,int16_t M3_speed,int16_t
M4_speed)
{

sprintf((char*)send_buff,"$spd:%d,%d,%d,%d#",M1_speed,M2_speed,M3_speed,M4_speed
);
    UART_Console_write(send_buff, strlen((char*)send_buff));
//    Send_Motor_ArrayU8(send_buff, strlen((char*)send_buff));
}


//控制pwm Control PWM
void Contrl_Pwm(int16_t M1_pwm,int16_t M2_pwm,int16_t M3_pwm,int16_t M4_pwm)
{
    sprintf((char*)send_buff,"$pwm:%d,%d,%d,%d#",M1_pwm,M2_pwm,M3_pwm,M4_pwm);
    UART_Console_write(send_buff, strlen((char*)send_buff));
//  Send_Motor_ArrayU8(send_buff, strlen((char*)send_buff));
}
```

Configure motor parameters

Contrl_Speed: Control the speed of 4 motors separately

Contrl_Pwm: Control 4 motors separately through PWM.

- empty.c

```
#define MOTOR_TYPE 5   //1:520电机 2:310电机 3:测速码盘TT电机 4:TT直流减速电机 5:L型
520电机
```

```
                        //1:520 motor 2:310 motor 3:speed code disc TT motor 4:TT
DC reduction motor 5:L type 520 motor

int main(void)
{
    USART_Init();
    printf("please wait...\r\n");

     //使能DMA通道  Enable DMA Channel
    NVIC_ClearPendingIRQ(UART_1_INST_INT_IRQN);
    DL_DMA_enableChannel(DMA, DMA_CH0_CHAN_ID);
    NVIC_EnableIRQ(UART_1_INST_INT_IRQN);

    //开启与K210串口通信的中断    Enable interrupts for communication with the K210
serial port
    NVIC_ClearPendingIRQ(UART_2_INST_INT_IRQN);
    NVIC_EnableIRQ(UART_2_INST_INT_IRQN);


    //设置电机类型    Set motor type
    Set_Motor(MOTOR_TYPE);

    printf("Initialization Succeed\r\n");

    while(1)
    {
        if (Get_CMD_Flag())
        {
            Upper_Data_Parse(Get_RxBuffer(), Get_CMD_Length());
            Clear_CMD_Flag();
        }
    }
}
```

MOTOR_TYPE: used to set the type of motor used. Modify the corresponding number according to the comments based on the motor you are currently using.

USART_Init: Initialize the serial port for communicating with the four-way motor driver board

Get_CMD_Flag: Start receiving data from k210

Upper_Data_Parse: Parse the received data from k210. And judge the function

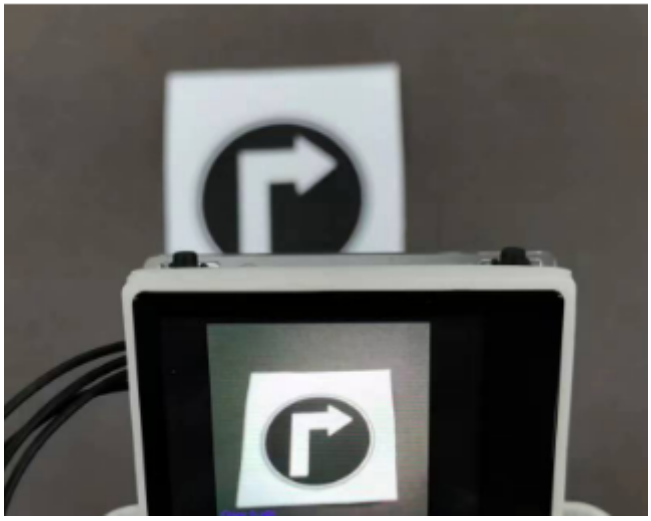
Clear_CMD_Flag: Clear the received data and related flags

4. Experimental operation

1. Burn the program to MSPM0.
2. Download the car drive library and PID control library in the K210\library directory to the root directory of the memory card in advance.
3. Open CanMV IDE and download the sign_motion.py code into the K210 module.
4. Connect all the wires of the car.
5. Put the car in a white or black background, move the K210 module bracket to a suitable angle, and turn on the car switch.

6. First, you need to learn the left turn icon. The operation steps are the same as the self-learning method. Take five pictures of the left turn icon according to the prompts on the screen.

7. Then learn the right turn icon and take five pictures of the right turn icon according to the on-screen prompts.



8. Then learn the stop icon and take five pictures of the stop icon according to the screen prompts.
9. After learning, the car starts to move forward. When the corresponding icon is detected in the image, the corresponding action is performed.

5. Experimental effect

After waiting for the system to be initialized, the car starts to move forward after learning the road signs according to the above steps. When a left turn road sign is detected in the camera image, the left turn function is executed, and then the car goes straight; when a right turn road sign is detected, the right turn function is executed, and then the car goes straight; when a stop road sign is detected, the car stops.

The turning range and function of the car can be modified in the `car_control` function. car_count indicates the turning time, and set_car_motion sets the turning speed.

```python
def car_control(class_id):
    global car_count, car_state
    car_state = 1
    if class_id == 1:# 向左转 turn left
        car_state = 1
        car_count = 10
        bot.set_car_motion(0, 0, 3)
    elif class_id == 2:# 向右转 turn right
        car_state = 1
        car_count = 10
        bot.set_car_motion(0, 0, -3)
    elif class_id ==3: # 停止 stop
        car_state = 0
        car_count = 0
        bot.set_car_motion(0, 0, 0)
```