Drive motor and read encoder-USART

1.1 Explanation

Please read 《0. Motor introduction and usage》first to understand the motor parameters, wiring method, and power supply voltage you are currently using. To avoid improper operation and damage to the driver board or motor.

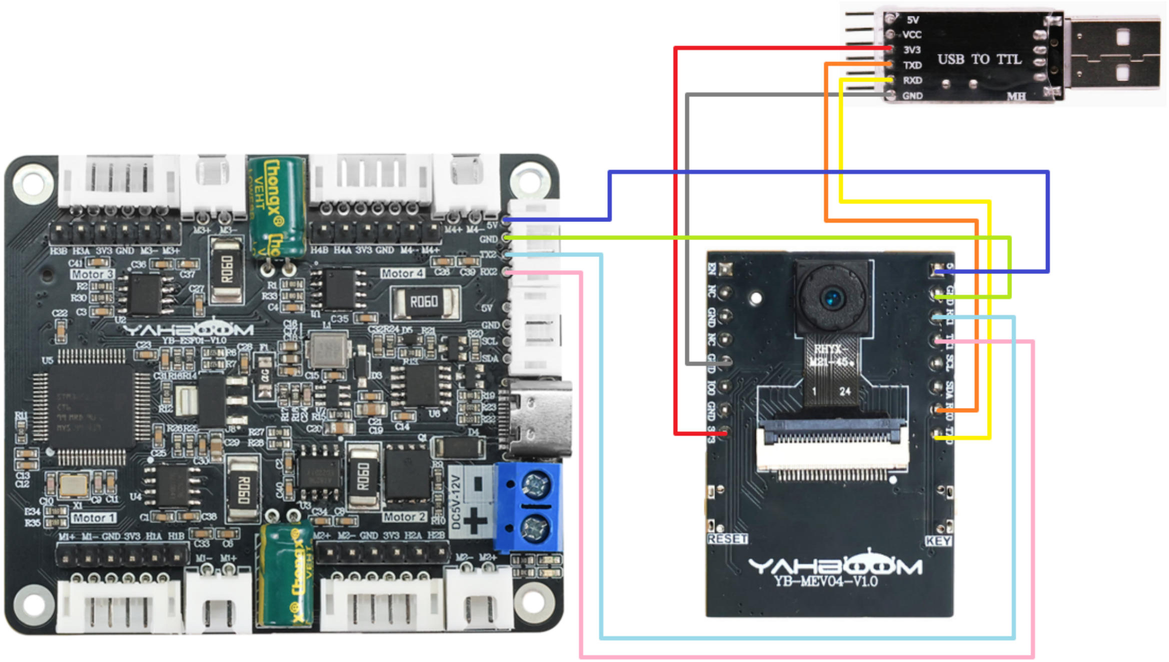
I2C and serial communication cannot be shared, only one can be selected.

This course uses the YahboomESP32 image transmission module lite version.

If you use other ESP32-S3 boards, you need to modify the pin settings in the program according to your board pin situation.

Use ESP-IDF 5.4.0 version to compile the project.

Hardware wiring:



Motor	4-channel motor drive board(Motor)
M2	M-
V	3V3
A	H1A
B	H1B
G	GND
M1	M+

4-channel motor drive board	ESP32S3
RX2	TX1
TX2	RX1
GND	GND
5V	5V

USB to TTL serial port module needs to be connected, mainly for printing data.

When using the Yahboom ESP32 image transmission module lite version, the 3V3 of the USB to TTL serial port module must be replaced with 5V and connected to the 5V on the ESP32 board to write the program normally.

After the program is written, it can be switched back to 3V3.

USB TO TTL	ESP32S3
3V3	3V3
TXD	RX0
RXD	TX0
GND	GND

Serial port configuration: **Baud rate 115200, no parity check, no hardware flow control, 1 stop bit**

1.2 Code analysis

```
#define UART1_TX_PIN    36
#define UART1_RX_PIN    35
```

This code is defined in the `uart_module.h` file.

If you need to change the pin for the serial port to communicate with the four-way motor driver board, you can modify the number here.

```
#define UPLOAD_DATA 3  //0:不接受数据 1:接收总的编码器数据 2:接收实时的编码器 3:接收电机当前速度 mm/s
                       //0: Do not receive data 1: Receive total encoder data 2: Receive real-time encoder 3: Receive current motor speed mm/s

#define MOTOR_TYPE 1   //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
```

- UPLOAD_DATA: used to set the data of the motor encoder. Set 1 to the total number of encoder pulses and 2 to the real-time pulse data of 10ms.
- MOTOR_TYPE: used to set the type of motor used. Just modify the corresponding numbers according to the comments according to the motor you are currently using. You don't need to modify the rest of the code.

If you need to drive the motor and observe the data, just modify the two numbers at the beginning of the program. No changes are required to the rest of the code.

```
  #if MOTOR_TYPE == 1
    send_motor_type(1);//配置电机类型 Configure motor type
    delay(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(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(100);
    send_wheel_diameter(67.00);//配置轮子直径,测量得出        Configure the wheel diameter and measure it
    delay(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(100);

  #elif MOTOR_TYPE == 2
  send_motor_type(2);
    delay(100);
    send_pulse_phase(20);
    delay(100);
    send_pulse_line(13);
    delay(100);
    send_wheel_diameter(48.00);
    delay(100);
    send_motor_deadzone(1600);
    delay(100);

  #elif MOTOR_TYPE == 3
  send_motor_type(3);
    delay(100);
    send_pulse_phase(45);
    delay(100);
    send_pulse_line(13);
    delay(100);
    send_wheel_diameter(68.00);
    delay(100);
    send_motor_deadzone(1250);
    delay(100);

  #elif MOTOR_TYPE == 4
  send_motor_type(4);
    delay(100);
    send_pulse_phase(48);
    delay(100);
    send_motor_deadzone(1000);
    delay(100);

  #elif MOTOR_TYPE == 5
  send_motor_type(1);
    delay(100);
    send_pulse_phase(40);
    delay(100);
    send_pulse_line(11);
    delay(100);
    send_wheel_diameter(67.00);
    delay(100);
    send_motor_deadzone(1900);
    delay(100);
  #endif
```

This is used to store the parameters of the Yahboom motor. By modifying the MOTOR_TYPE parameter above, one-click configuration can be achieved.

In normally, do not modify the code here when using the Yahboom motor.

If you are using your own motor, or if a certain data needs to be modified according to your needs, you can check the course《1.2 Control command》 to understand the specific meaning of each command.

```
void MotorControl_Task(void *arg) {
    static int i = 0;
    while(1) {
        if(g_recv_flag == 1)// 接收标志检查 | Check reception flag
        {
            g_recv_flag = 0;// 重置标志 | Reset flag

            // 根据电机类型选择控制方式 | Select control mode by motor type
            #if MOTOR_TYPE == 4
            Contrl_Pwm(i*20,i*20,i*20,i*20);// PWM控制模式 | PWM control
            #else
            Contrl_Speed(i*10,i*10,i*10,i*10);// 速度控制模式 | Speed control
            #endif

            Deal_data_real();

            #if UPLOAD_DATA == 1

printf("M1:%d,M2:%d,M3:%d,M4:%d\r\n",Encoder_Now[0],Encoder_Now[1],Encoder_Now[2],Encoder_Now[3]);
```

```
            #elif UPLOAD_DATA == 2
printf("M1:%d,M2:%d,M3:%d,M4:%d\r\n",Encoder_Offset[0],Encoder_Offset[1],Encoder_Offset[2],Encoder_Offset[3]);
            #elif UPLOAD_DATA == 3
printf("M1:%.2f,M2:%.2f,M3:%.2f,M4:%.2f\r\n",g_Speed[0],g_Speed[1],g_Speed[2],g_Speed[3]);
            #endif

            i = (i < 100) ? i+1 : 0;
            delay_ms(100);
        }
        delay_ms(1);// 防止任务卡死 | Preventing tasks from getting stuck
    }
}
```

In the main program loop, the speed of the four motors will be slowly increased from 0 to 1000. If the motor type is 4, that is, the motor without encoder, the PWM of the motor is directly controlled.

At the same time, the data sent by the driver board is read and printed out.

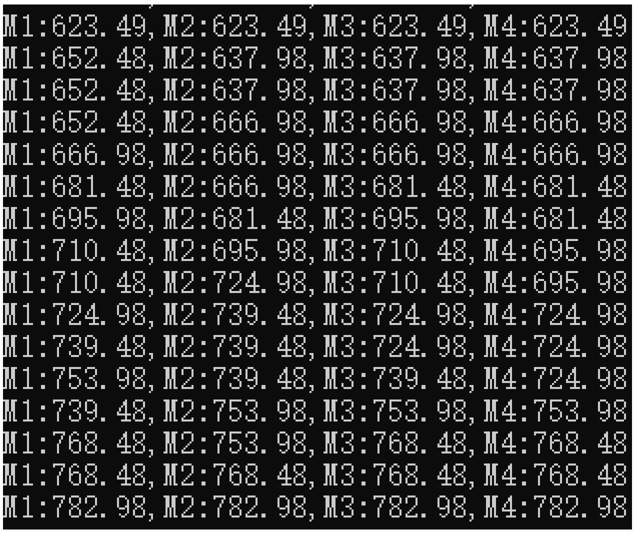
```
//检验从驱动板发送过来的数据，符合通讯协议的数据则保存下来
//Check the data sent from the driver board, and save the data that meets the communication protocol
void Deal_Control_Rxtemp(uint8_t rxtemp)
{
    static u8 step = 0;
    static u8 start_flag = 0;

    if(rxtemp == '$' &&     start_flag == 0)
    {
        start_flag = 1;
        memset(g_recv_buff,0,RXBUFF_LEN);//清空数据 Clear data
    }

    else if(start_flag == 1)
    {
            if(rxtemp == '#')
            {
                start_flag = 0;
                step = 0;
                g_recv_flag = 1;
        // 检查前四个字符  Check the first four characters
    if (strncmp("MAll:",(char*)g_recv_buff,5)==0 ||
        strncmp("MTEP:",(char*)g_recv_buff,5)==0 ||
        strncmp("MSPD:",(char*)g_recv_buff,5)==0) {
        if (isValidNumbers((char*)g_recv_buff + 5)) {
                // 如果符合条件，打印数据  If the conditions are met, print the data
                memcpy(g_recv_buff_deal,g_recv_buff,RXBUFF_LEN);
            }
    } else {
        // 不匹配时清除缓冲区，避免残留无效数据 Clear the buffer when there is no match to avoid residual invalid data
        memset(g_recv_buff, 0, RXBUFF_LEN);
    }
            }
            else
            {
                if(step > RXBUFF_LEN)
                {
                    start_flag = 0;
                    step = 0;
                    memset(g_recv_buff,0,RXBUFF_LEN);//清空接收数据   Clear received data
                }
                else
                {
                    g_recv_buff[step] = rxtemp;
                    step++;
                }
            }
    }

}

//将从驱动板保存到的数据进行格式处理，然后准备打印
//Format the data saved from the driver board and prepare it for printing
void Deal_data_real(void)
{
     static uint8_t data[RXBUFF_LEN];
   uint8_t  length = 0;
    //总体的编码器   Overall encoder
     if ((strncmp("MAll",(char*)g_recv_buff_deal,4)==0))
    {
        length = strlen((char*)g_recv_buff_deal)-5;
        for (uint8_t i = 0; i < length; i++)
        {
            data[i] = g_recv_buff_deal[i+5]; //去掉冒号 Remove the colon
        }
                data[length] = '\0';
                char* strArray[10];//指针数组 长度根据分割号定义  char 1字节   char* 4字节    Pointer array The length is defined by the split number char 1 byte char* 4 bytes
                char mystr_temp[4][10] = {'\0'};
                splitString(strArray,(char*)data, ", ");//以逗号切割 Split by comma
                for (int i = 0; i < 4; i++)
                {
                        strcpy(mystr_temp[i],strArray[i]);
                        Encoder_Now[i] = atoi(mystr_temp[i]);
                }

        }
        //10ms的实时编码器数据  10ms real-time encoder data
        else if ((strncmp("MTEP",(char*)g_recv_buff_deal,4)==0))
    {
        length = strlen((char*)g_recv_buff_deal)-5;
        for (uint8_t i = 0; i < length; i++)
        {
            data[i] = g_recv_buff_deal[i+5]; //去掉冒号 Remove the colon
        }
                data[length] = '\0';

                char* strArray[10];//指针数组 长度根据分割号定义  char 1字节   char* 4字节      Pointer array The length is defined by the split number char 1 byte char* 4 bytes
                char mystr_temp[4][10] = {'\0'};
                splitString(strArray,(char*)data, ", ");//以逗号切割 Split by comma
                for (int i = 0; i < 4; i++)
                {
                        strcpy(mystr_temp[i],strArray[i]);
                        Encoder_Offset[i] = atoi(mystr_temp[i]);
                }
        }
        //速度    Speed
        else if ((strncmp("MSPD",(char*)g_recv_buff_deal,4)==0))
    {
        length = strlen((char*)g_recv_buff_deal)-5;
        for (uint8_t i = 0; i < length; i++)
        {
            data[i] = g_recv_buff_deal[i+5]; //去掉冒号 Remove the colon
        }
                data[length] = '\0';

                char* strArray[10];//指针数组 长度根据分割号定义  char 1字节   char* 4字节      Pointer array The length is defined by the split number char 1 byte char* 4 bytes
                char mystr_temp[4][10] = {'\0'};
                splitString(strArray,(char*)data, ", ");//以逗号切割 Split by comma
                for (int i = 0; i < 4; i++)
                {
                        strcpy(mystr_temp[i],strArray[i]);
                        g_Speed[i] = atof(mystr_temp[i]);
                }
        }
}
```

- Deal_Control_Rxtemp: Filter the received data and save those that meet the communication protocol.
- Deal_data_real: Extract the saved original data and reconstruct a new print format.

1.3 Experimental phenomenon

After the wiring is correct, write the program into the mainboard. After powering on again, you can see that the motor will gradually speed up, then stop, and repeat.

At the same time, you can see the motor value constantly changing in the serial monitor.



```
M1:623.49,M2:623.49,M3:623.49,M4:623.49
M1:652.48,M2:637.98,M3:637.98,M4:637.98
M1:652.48,M2:637.98,M3:637.98,M4:637.98
M1:652.48,M2:666.98,M3:666.98,M4:666.98
M1:666.98,M2:666.98,M3:666.98,M4:666.98
M1:681.48,M2:666.98,M3:681.48,M4:681.48
M1:695.98,M2:681.48,M3:695.98,M4:681.48
M1:710.48,M2:695.98,M3:710.48,M4:695.98
M1:710.48,M2:724.98,M3:710.48,M4:695.98
M1:724.98,M2:739.48,M3:724.98,M4:724.98
M1:739.48,M2:739.48,M3:724.98,M4:724.98
M1:753.98,M2:739.48,M3:739.48,M4:724.98
M1:739.48,M2:753.98,M3:753.98,M4:753.98
M1:768.48,M2:753.98,M3:768.48,M4:768.48
M1:768.48,M2:768.48,M3:768.48,M4:768.48
M1:782.98,M2:782.98,M3:782.98,M4:782.98
```