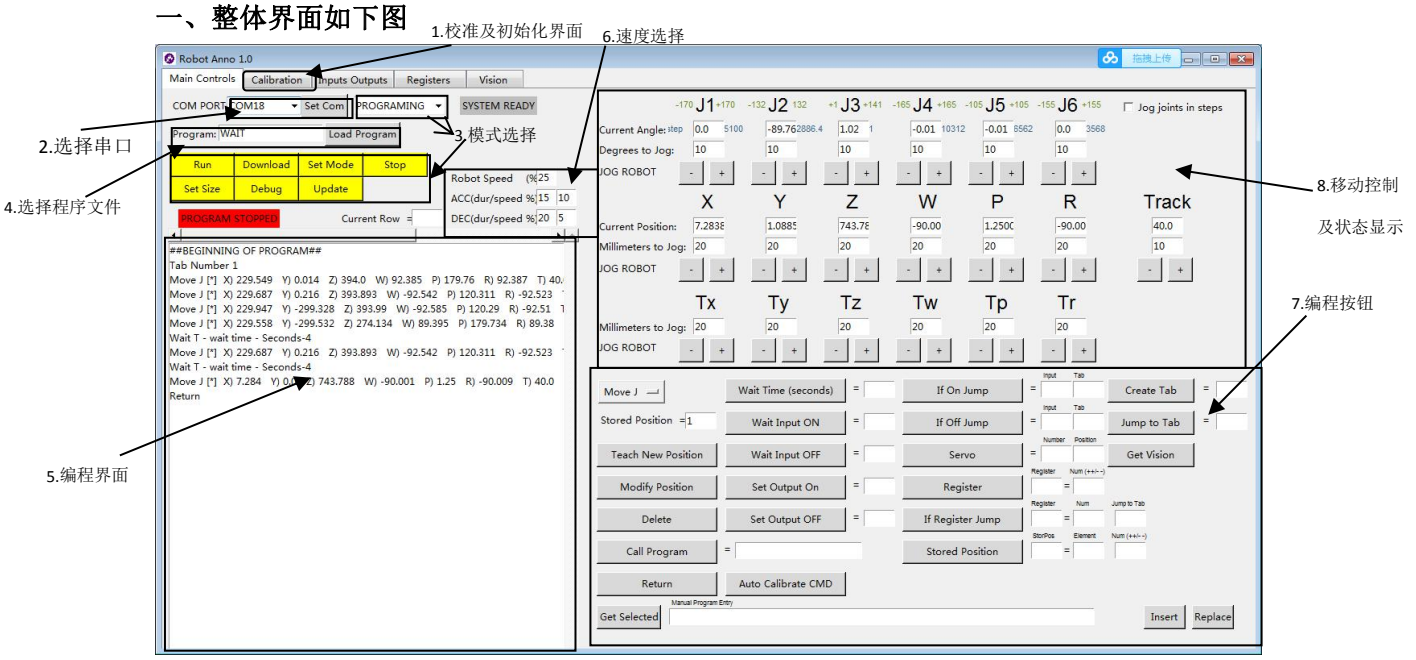
Robot Anno1.0 使用说明

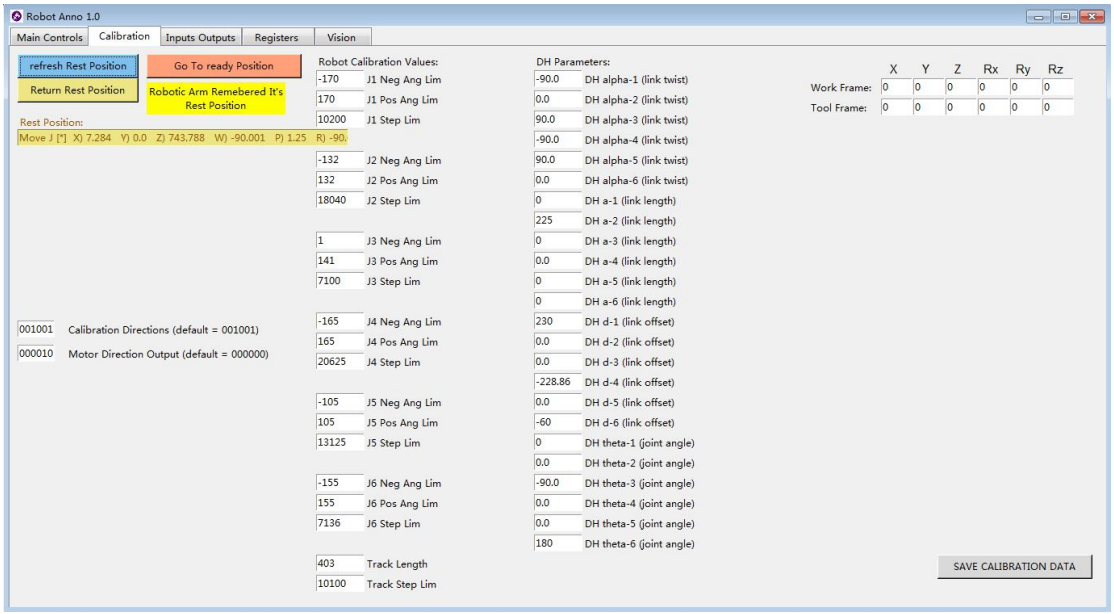
基于 arduino mega 2560 控制器，可以实现六轴机械臂的位置坐标、IO 口和舵机控制，通过上位机软件既可以在线编程指令进行动作、IO 口、舵机控制，也可以实现实现程序的下载实现离线运行下载的动作指令。开源了下位机的控制程序，用户可以通过改动接口来实现 DIY 的六轴机械臂控制。源码的公开，可以极大的方便用户进行二次开发和优化。

Based on the arduino mega 2560 controller, the position coordinates, IO port and steering gear control of the six-axis manipulator can be realized. The upper computer software can not only program the action instructions online, IO port, steering gear control, but also realize the download of the program to realize the offline operation of the downloaded action instructions. The control program of the lower computer is open source, and the user can control the six-axis manipulator of DIY by changing the interface. Open source code, can greatly facilitate users to carry out secondary development and optimization.

一、整体界面如下图



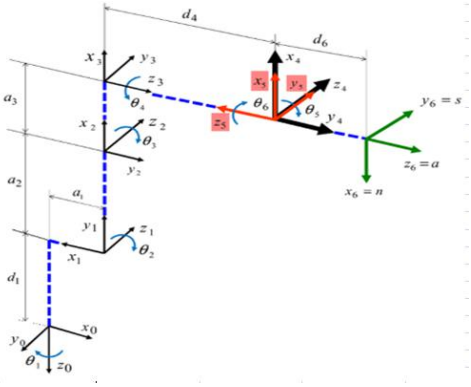
1.校准及初始化界面



此界面可以输入六轴机械臂的 DH 参数、每一个转动关节的活动角度范围、每一个关节处的步进电机在活动角度范围内走的步数总和。

This interface can input the DH parameters of the six-axis manipulator, the range of the moving angle of each rotating joint, and the sum of the steps of the stepping motor at each joint in the range of the moving angle.

DH 参数参考(DH parameter reference)



活动角度范围根据具体情况而定。

步数总和=步进电机单位（度/步）*（最大最小角度绝对值之和）

Refresh Rest position：将机械臂初始竖直状态的空间坐标值记录下来并作为校准位置

Return to Rest position：移动到校准位置

Go to ready position：移动到编程准备位置

The range of activity angles depends on the specific circumstances.

Sum of steps = unit of step motor (degree / step) * (sum of absolute values of maximum and minimum angle)

Refresh Rest position: records the spatial coordinate values of the initial vertical state of the manipulator as calibration positions

Return to Rest position: moves to calibration position

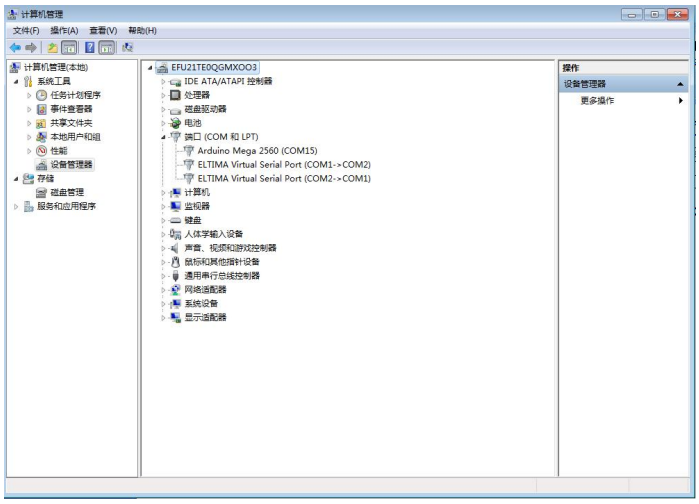
Go to ready position: moves to programming preparation location

2.下拉列表中包含电脑所连接外部设备的所有串口号。

如下图所示 鼠标单击我的电脑，右键选择管理，可在设备管理器中查看 arduino 的通信串口号。选择 arduino 的串口号完成后直接点击 Set Com 连接

The drop-down list contains all the string numbers for the external devices to which the computer is connected.

Click on my computer and right-select management as shown in the following figure to view the communication string number of arduino in device Manager. Select the string number of arduino and click on the Set Com connection directly after completing



3.模式选择

可供选择 PROGRAMING DOWNLOAD 两种模式。

Run:运行编程界面中的程序
Debug:运行下载到机械臂控制箱中的程序
Stop:停止编程界面中正在运行的程序
Updata:在机械臂运行预下载后的程序后，可通过此按键更新上位机的位置状态数据以匹配此时机械臂的位置。
Set Size:告诉控制箱要下载的代码行数
Download：下载程序
4.可以在 Program：后方写入 txt 文件的名称，点击 load program 即可在下方的程序界面中显示文件的内容。一般要读取的 txt 文件都应该放置本程序所在的同一目录下。
5.此处文本框即为编程界面，可以看到 txt 文件里面的每一行指令，启动按钮程序会从第一行进行读取指令并发送。Stop 可以直接终止程序运行。Current Row：显示的是鼠标在编程界面中所选的某一行代码的位置。
6.步进电机采用的事梯形加减速移动，此处可以输入步进电机在运动中三个阶段的速度，分别控制加速、匀速、减速的速度。
7.通过各个按钮来实现对六轴机械臂的在线编程。
Wait Time:设置延时时间单位为秒。
IF on JUMP 判断输入口状态，如果为开启状态则跳入程序节点段 TABX。
Create Tab:创建某一程序节点段。可以实现循环控制的效果。
Wait Input on:等待 X 秒后输入口状态为开启状态。
Jump Tab:程序直接跳入到某一程序节点段。
Teach New Position:将此时机械臂所处的位置坐标写成指令发送到编程界面中。
Servo 控制某舵机转动相应角度
Modify Position：修改某段程序的位置坐标指令
Set Output On:将某输出口设置为开启状态
Register:在程序中设置一寄存器来达到计数的功能。可以控制循环的次数
Delete:删除所选取的一行程序指令
Call program:读取所选行程序指令到对话框中，功能与 Get select 相似
Auto Calibration CMD 自动返回初始设定的角度
Insert:将对话框中程序代码写入程序界面中。
8. 在此处显示六轴机械臂的实时位置状态和关节数据。可以在这里直接控制关节和移动笛卡尔坐标系下的位置，同时可以直接控制末端执行器的空间位置。
J1-J6：代表六个关节数据
X、Y、Z、W、P、R:代表末端执行器相对于第一轴的笛卡尔位置坐标值。
TX、TY、TZ、TW、TP、TR：代表末端执行器坐标系中的位置移动坐标值。
二、下载程序步骤：
Tips:由于上位机进行机械臂的正逆解运算，所以下载到电控箱的程序只包含每个关节转动的角度。目前下载程序只支持下载仅包含移动和等待时间指令的代码。其余指令的下载正在开发中。
第一步：点击 calibration 界面中的 refresh 按键
第二步：在下拉框中选择 Download,并按下 Set Mode 按钮
第三步：鼠标点击程序的最后一行（最后一行应为移动或者等待时间指令）并按下 Set Size 按钮
第四步：鼠标点击程序第一行并点击 Download 按钮即可完成代码下载。
注意事项：

点击 Download 按钮前应注意右边关节和笛卡尔坐标系数据为机械臂竖直时状态值，若不是，可以点击 Reresh rest position 按钮刷新数据。

若想离线后重复运行，应在程序界面中的最后一行写入初始时的位置坐标。

3. Mode selection

You can select two modes:PROGRAMIN GDOWNLOAD.

Run: runs programs in the programming interface

Debug: runs the program downloaded to the manipulator control box

Stop: stops running programs in the programming interface

After running the pre-downloaded program, Updata: can update the position status data of the upper computer to match the position of the manipulator at this time.

Set Size: tells the control box the number of lines of code to download

Download: Download program

4. You can write the name of the txt file only after the Program: and click the load program to display the contents of the file in the program interface below. The txt file you normally want to read should be placed under the same directory as the program.

5. Here the text box is the programming interface, you can see each line of instruction in the txt file, the startup button program will read the instruction from the first line and send. Top can directly terminate the program to run the. Current Row: showing the location of a line of code selected by the mouse in the programming interface.

6. Step motor adopts ladder acceleration and deceleration movement, where the speed of step motor in three stages of motion can be input, and the speed of acceleration, uniform speed and deceleration can be controlled respectively.

7. The online programming of the six-axis manipulator is realized by each button.

Wait Time: sets the delay time in seconds.

IF on JUMP determines the input state and jumps into the program node segment TABX. if it is on

Create Tab: creates a program node segment. The effect of cycle control can be realized.

Wait Input on: waits for X seconds and the input state is open.

Pump Tab: The program jumps directly to a program node segment.

Teach New Position: writes the coordinates of the manipulator at this time as instructions to send them to the programming interface.

Servo controls the rotation angle of a steering gear

Modify Position: modifies the position coordinate instruction of a program

Set Output On: sets an output port to open

Register: Set a register in the program to reach the function of the count. the number of cycles that can be controlled

Delete: removes the selected line of program instructions

Call program: reads the selected line of program instructions into the dialog box, with functions similar to those of Get select

AutoCalibrationCMD automatically returns to the initial set angle.

Insert: writes the program code in the dialog box to the program interface.

The real-time position status and joint data of the six-axis manipulator are displayed here. The position of the joint and the Cartesian coordinate system can be directly controlled here, and the spatial position of the end actuator can be directly controlled at the same time.

J1 / J6: represents six joint data

X, Y, Z, W, P, R: represents the Cartesian coordinate value of the end actuator relative to the first axis.

TX,TY,TZ,TW,TP,TR: represents the position movement coordinate value in the end actuator coordinate system.

Download program steps:

Because the upper computer carries on the forward and inverse solution operation of the manipulator, the program downloaded to the electric control box only contains the angle of each joint rotation. At present, the download program only supports downloading code that contains only moving and waiting time instructions. The download of the rest of the instructions is under development.

Step 1: click the refresh button in the calibration interface

Step 2: select Download, in the drop-down box and press the Set Mode button

Step 3: click on the last line of the program (the last line should be the move or wait time instruction) and press the Set Size button

Step 4: click on the first line of the program and click on the Download button to complete the code download.
Precautions:

Before clicking the Download button, note that the data in the right joint and Cartesian coordinate system is the state value when the manipulator is vertical. If not, you can click the Reresh rest position button to refresh the data.

If you want to run repeatedly after offline, you should write the initial position coordinates on the last line of the program interface.