SKCON9 User manual

version: 20190425

Abilix WER World Educational Robot Contest

table of Contents

1 Preface

SK Skilsense CON

Quite knowledgeable, 9 At the same time, it has many educational functions and stable and reliable artificial intelligence required for educational robot teaching and competition. Its appearance

SKCON9 In terms of hardware, while continuing the design style of the building block series, the shell provides more structural holes to support

Six sides overlap, fully realize the space expansion; software, support flowchart programming, bar graph programming, C Language programming

and Python Language programming provides you with rich learning and application methods!

This book introduces SKCON9 And the functions of the supporting software and how to use it, the examples provided in the book can help

You learn better to improve the efficiency of the product.

Note: The supporting software of the product depends on the product model, and the actual product shall prevail.

2SKCON9 Introduction

2.1 Core functions and parameters

SK Sc(1)ON . 5 Inch color touch screen, you can complete the program operation and read the sensor (external

Place and inside , 9 Equipped of reads, fast programming, debugging motors and settings, and can display color static pictures, dynamic pictures,

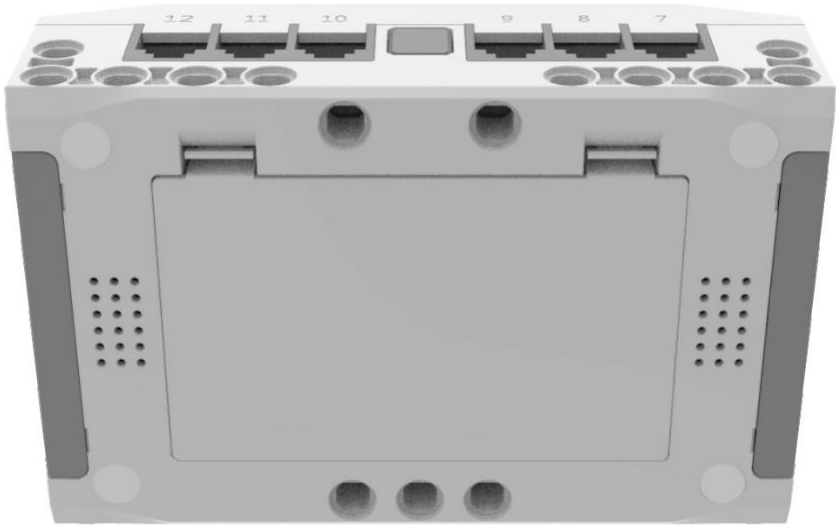
Image documents such as text.

SK Sc(1)ON S B, Wired interface and W ireless function, support wireless upgrade firmware and network update system

System! Inside tooth Yahboom U Device Microphone, top Support a variety of external sensor actuators, support image mode

Block, support smart motor (steering gear), closed loop motor!

SKCON9 Support detachable dedicated lithium battery power supply, system built-in power monitoring, to meet the needs of teaching and competition.



SK Item SKCON9 Supports Stackless, modular to use some bolts, can be assembled with the building blocks (Krypton series) into abundance Rich item

SKCON9 With powerful hardware configuration, the core parameters are as follows:

a) Dual processors: MTK6580 CPU , 1.3GHz , 4G FLASH , 512M RAM ； 32 Bit Cortex-M3 STM32F103VET6) CPU , 72MHz (, 512K FLASH , 64K SRAM .

b) I/O Interface: Total 12 Way, adopt RJ11 Socket, used in conjunction RJ11 Plug cable, firm structure And easy to plug. Port has analog input (AI), digital input (DI), digital output (DO), UART Serial universal asynchronous communication interface (10 Way) and reusable I²C Bus synchronous serial communication interface (2 road).

c) Motor interface: total 4 road(RJ11). The port has a closed-loop control function and supports controlling the steering of the motor. The output voltage is the battery voltage, and the maximum current supported by a single channel is 1.5A . The port also supports reading motor encoders return value.

d) SERVO Interface: Total 1 road(RJ11), 485 Bus control, controllable 11 A smart motor.

e) Artificial intelligence module interface: total 1 Road, adopt standard USB-A Interface, support image module, voice module, Used for robot learning and recognition.

f) Wired connection interface: total 1 Road, adopt standard USB-C Interface, with the use of universal data line, operation Convenient and reliable. Supports wired download of user programs.

g) Built-in wifi ,stand by WLAN (only 2.4G) And hot spots 2 A wireless mode, support wireless download user program Sequence and wireless upgrade firmware.

h) Built-in gyroscope, support acquisition 3 The axis angle return value.

i) Built-in microphone, support to obtain sound intensity return value (analog). Support recording.

j) Built-in speaker, support playback " Hello and goodbye "" Piano, drum set " And other built-in audio and recording files.

2.2 Battery use and switch operation

SKCON9 Operating Voltage 7-8.4V , Use a dedicated battery for power supply.

Dedicated lithium battery: 7.4V , 1500mAh , 11.1Wh , Support independent charging.

The battery needs to use a dedicated 8.4V1A The charger is charging. When the indicator light on the charger is red, it means Charge, the battery will turn green when fully charged.

After installing the battery, long press (about 3 Sec) power button to turn on. After the controller is turned on, no matter in any interface, Long press the power button (about 3 Seconds) to shut down.

Note: In the power-on state, short press the power button, the operation interface returns to the previous level.

* Instructions for battery and charger

1. Regularly check whether the charging plug, wire and other parts are damaged. If damage is found, stop using it until Repaired intact;

2. Do not use other types of batteries and chargers that are not specified by the company;

3. The battery should be removed from the product before charging, and can only be charged under adult supervision;

4. Press the lithium battery into the back of the controller according to the front facing out and the back facing in to complete the installation. Push the battery buckle

Removable battery;

5. Used batteries should be taken out of the product;

6. Avoid liquid flowing into the controller and the lithium battery, so as not to cause battery power supply and short circuit of power terminals;

7. When the battery is not energized or cannot be charged, it can only be replaced by the service provider authorized by Ability Storm or Ability Storm.

change;

8. Batteries must be recycled or disposed of separately from household garbage;

9. It is strictly prohibited to use the product while charging.

3SKCON9 Operation interface

3.1 Main interface

SKCON9 After booting, the operation interface presented to you is shown in the figure above, click on the function module to enter 2 level interface.

3.2 My program

My program: store the downloaded program (programming software is required, see "SKCON9 Programming software ").

Each line in the list is a program, click one of them, the program starts to run, slide one of them, you can select Choose Delete.

The program name suffixes are respectively. c versus. py ,Representing C Language program (using Abilix Chart 3.0 Programming) versus Python Language program (using Abilix Scratch 3.0 Programming).

Note: When the program is running, if there is " display " Code, the corresponding information will be displayed on the screen.

3.3 Fast programming

Fast programming: Simple bar graph programming tool, which can realize local programming, and quickly realize simple debugging.

Drag the program module into the programming area on the right, and click the play button  to run the program; click save Button  Save the current program (save as multiple programs is not supported), otherwise the program will be Empty.

3.4 Read sensor

Reading sensors: reading built-in and external sensors, including grayscale, collision sensors and built-in gyroscopes, etc.

Including motor encoder (via motor interface), smart motor ID Number and angle, etc.

Swipe up the interface to show more content.

3.4.1 I/O interface

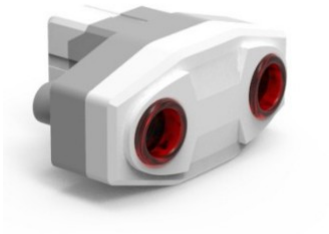
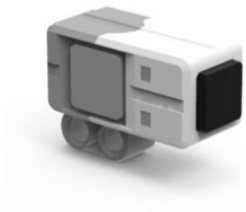
Read port 1~12 , With the function of identifying the sensor type, once the sensor is connected, the interface corresponds to the port

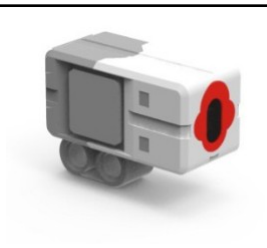
Immediately refresh the name of the recognized sensor type, and display its return value on the interface in real time. Disconnected immediately

for " port xx : 0" .

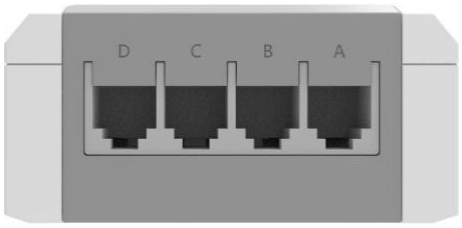
The return value range of each sensor is different, please refer to the following table:

sequence number	name	Schematic diagram	Return value range

1	Grayscale		0~4095
2	collision		0 , 1
3	Ultrasound		50~1500
4	flame		0~4095
5	temperature		0~40
6	Magnetic sensitivity		0 , 1
7	humidity		0~100%

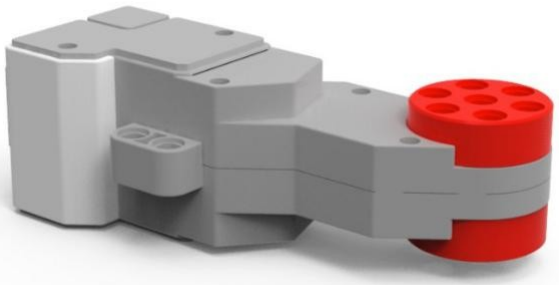
8	Infrared		0~1200mm
9	angle		0~359
10 colour			Color recognition mode: White 0 ,black 1 ,red 2 ,green 3 , Blue 4 ,yellow Photosensitive mode 5 0-4095

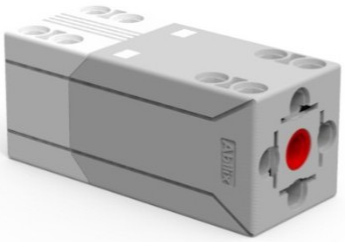
3.4.2 Motor interface



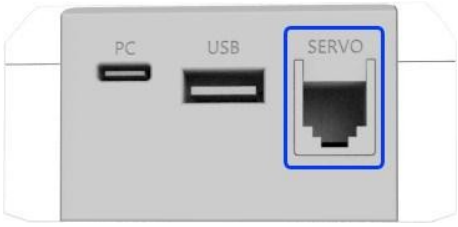
port A~D , Can read the return value of the motor encoder in real time (analog quantity). After the first connection, the return value is 0 ,

By rotating the output terminal of the motor, the return value changes accordingly.

Ordinal number	name	Schematic diagram	Return value range
1	Closed loop Motor		-99999~99999

2	Closed loop small -99999~99999 Motor		

3.4.3 SERVO interface



port SERVO , When the smart motor is switched on, it will display at the same time ID Number and current angle value.

sequence number	name	Schematic diagram	Return value range
1	Smart motor		-90~90

By shaking the output terminal of the intelligent motor, the return value changes accordingly. Note: The resistance in the connected state is relatively large. Please pay attention to safety when working.

In the schematic diagram: SERVO Interface connected 1 A ID for 01 Smart motor and the current angle is- 30 degree.

Support multiple series connection (dedicated cable is required, depending on the actual product configuration, but also can contact the capacity storm customer The service center pays to obtain it. Please refer to the end of this book for contact details.

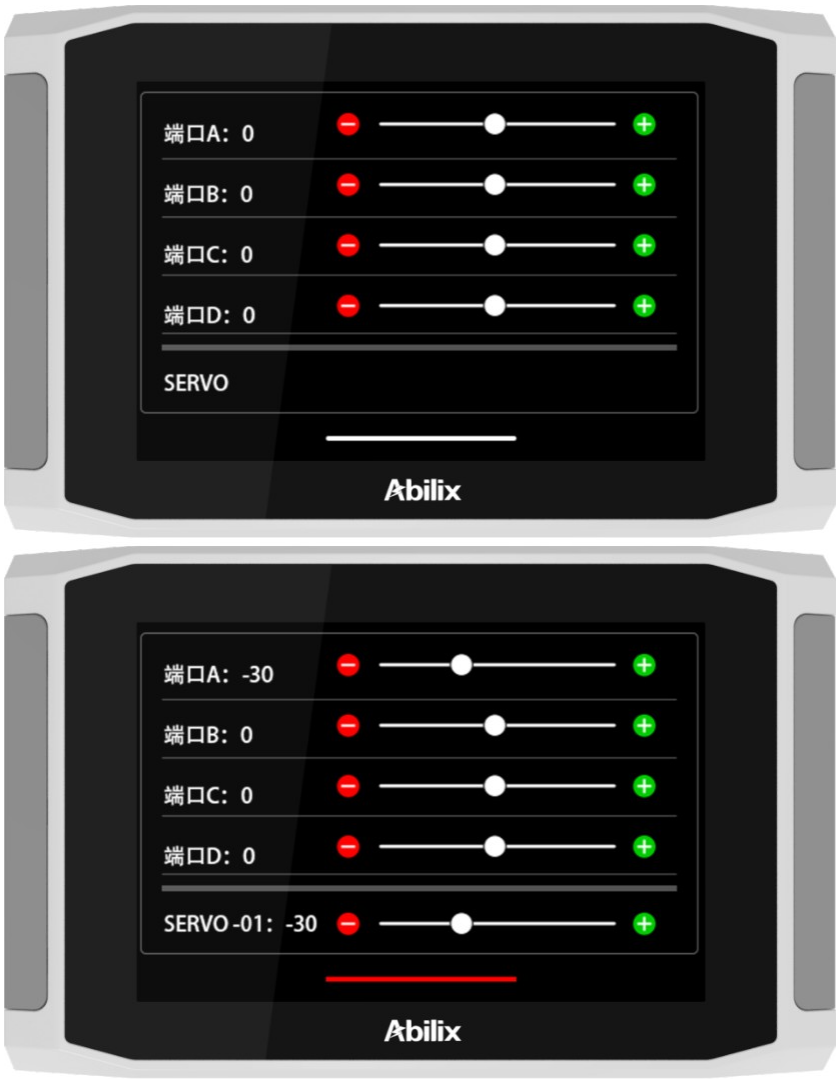
3.4.4 Built-in gyroscope

" Gyro X , Y , Z" It is the return value (angle value) of the built-in gyroscope.

3.4.5 Built-in sound intensity detection

" Sound intensity " It is the return value of the built-in microphone (analog).

3.5 Commissioning the motor



Debug motor: debug the speed of closed-loop large motor, closed-loop small motor, and debug the angle of smart motor.

Adjust the value by sliding the slider or the motor plus and minus buttons, when the value is not 0 When, the back button turns red, and then through

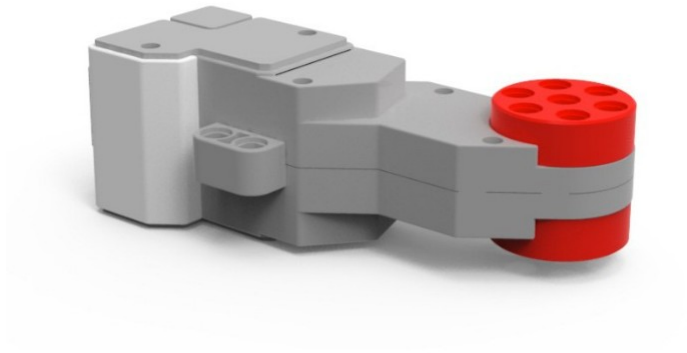
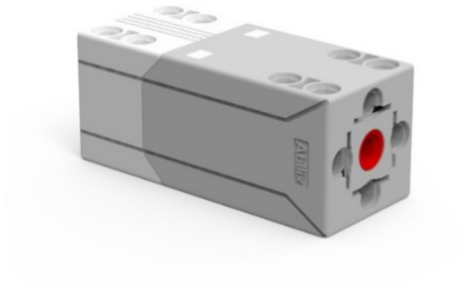
Click the back button to clear all values.

Note: Enter " Commissioning the motor " After the interface, pay attention to avoid the output terminal of the motor and smart motor, otherwise there may be storage

In the risk of friction or squeezing; it is strictly prohibited to manually rotate the output end of the motor or shake the output end of the intelligent motor, otherwise there may be

The risk of damaging the hardware is an act of artificially damaging the product.

sequence Number name	Schematic diagram	Value range

1 Closed loop Motor		-100~100
2 Closed loop small Motor		-100~100
3 Smart electricity machine		-90~90

3.6 Read and write data

Read and write data: plastic data can be stored, the data will not be lost when the machine is turned on and off. total 128 Data.

All data can be modified and saved in the interface, and can also be read and written through programming software.

3.7 Set up

3.7.1 name

The name of the machine, used for personalized settings, support customization, length 1~20 Characters.

3.7.2 WLAN

Can be SKCON9 Connect to a wireless LAN.

3.7.3 Hot spot

When the local hotspot is turned on, you can wifi This hot spot is found in the functional computer network-wireless network.

Hotspot name varies with " Settings-name " It depends, each time you change your name, you usually need to switch the hotspot again.

The hotspot password supports manual modification.

3.7.4 Language

Set the operation interface language, support simplified Chinese, English.

3.7.5 volume

Set the speaker volume, 0~100% .

3.7.6 Power

Display the current battery, 0~100% .

3.7.7 version

Display the operating system version.

3.7.8 system update

Update the operating system.

Note: Please make sure the battery is greater than 30% , Please make sure that SKCON9 Connect to the internet.

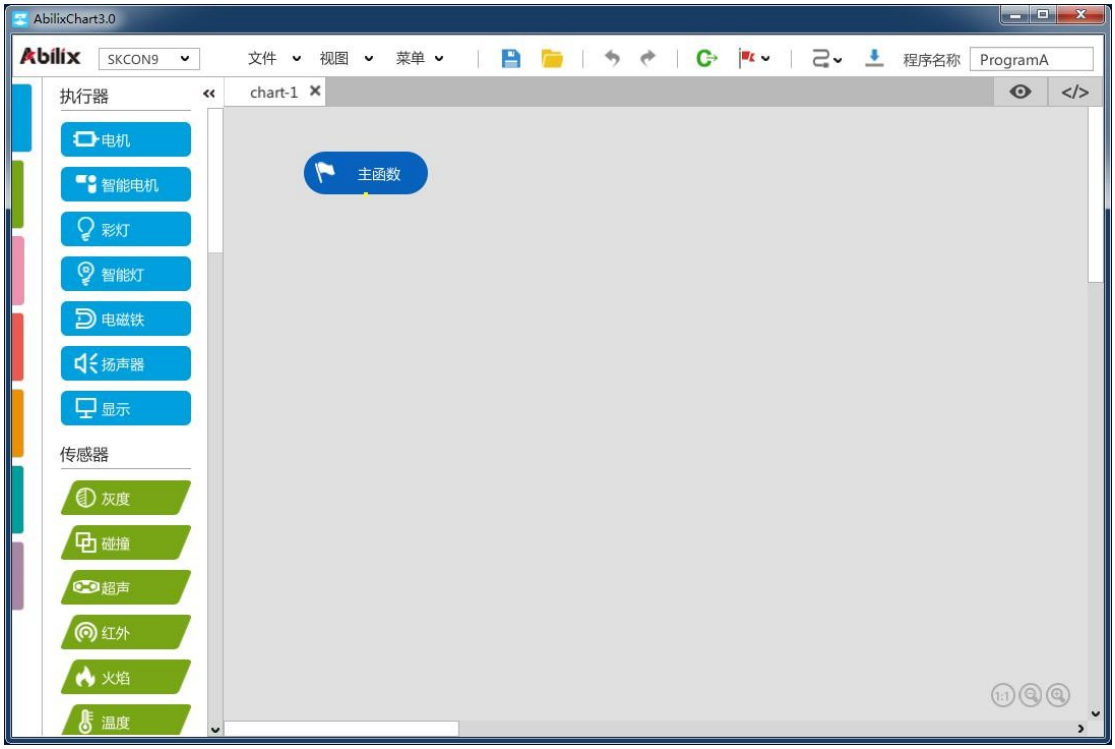
4SKCON9 Programming software

SKCON9 Support flowchart programming, C Language programming, bar graph programming and Language programming, interactive friends Good, powerful, low entry barrier for beginners, fast advancement, and wide room for advanced expansion! Python

Serial number	name of software	Programmatically	homescreen icon
1	Abilix Chart 3.0	Flowchart programming C Language programming	
2	Abilix Scratch 3.0	Bar graph programming Python Language programming	

You can obtain the matching software installation files in the product CD, or by visiting the official website of Ability Storm www.abilix.com ,in " Technical Service/Data Download " Obtained from the page.

4.1 Abilix Chart 3.0



Using standard flowchart programming method, support C Code control display, support one-key turn of graphic programming C Code programming. Support wireless and wired downloads.

4.1.1 toolbar

1) Select model: support Abilix More products under the brand

Note:

a) It will take effect immediately after selection, and it will be retained until another selection

b) Before selecting again, pay attention to save the current program file

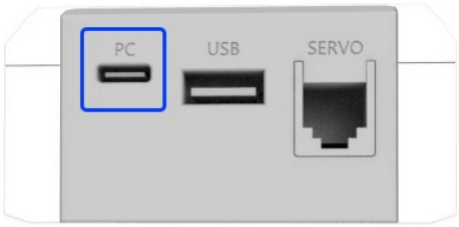
2) Text Files, views, menus;

3) Save and open;

4) Go back to the previous step and redo the next step;

5) Jump to C Language programming environment, selection function;

6) Select the online method, download the program, and fill in the program name.

Wired connection and download		
first step	Use standard USBC Cable connection SKCON9" port PC" With computer	
Second step	select " Wired connection "	
third step	Click on " download "	
the fourth step	carry out	

Connect wirelessly and download

first step	make sure SKCON9 With electricity Brain connected to the same local area network	 
Second step	select " wireless connection "	
third step	Click on " download "	
the fourth step	enter SKCON9 The net Network IP address	
the fifth step	Waiting for connection and download	

Sixth step	carry out	

Remarks: After the first wireless connection is successful, the connection mode icon will change. When downloading the program again, no input is required IP Address until the network is changed. When you need to wirelessly connect to another controller, click the IP Just disconnect the current connection in the address bar.

4.1.2 Programming area

By using the mouse, drag the required program module to the programming area to design the flow chart program;

To set a certain program module in detail (when it can be set), in the programming area, double-click this module, in the second window Just set it in the mouth, and it will take effect after confirming that it is closed.

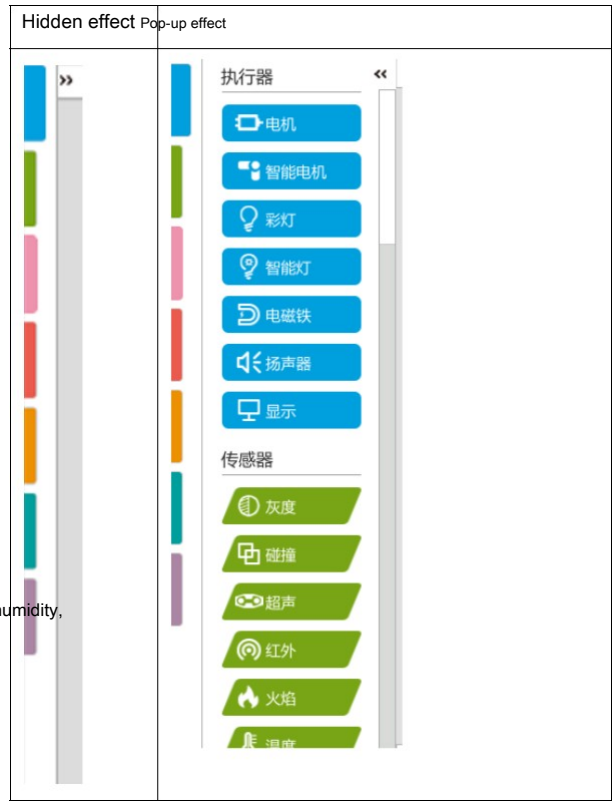
4.1.3 Code preview area

When you are " Programming area " When programming, once the module is connected to " Main function " (Or new letter Number), the code of the current graphics program can be displayed synchronously in the area on the right.

Note: This area can be customized to show or hide, </> The button is visible at the bottom right of the toolbar.

4.1.4 Program module library

By clicking « Hide or pop module library



4.1.4.1 **Actuator module**

contain:

External actuator: motor, smart motor, color Lights, smart lights, electromagnets

Built-in actuator: speaker, display

4.1.4.2 **Sensor module**

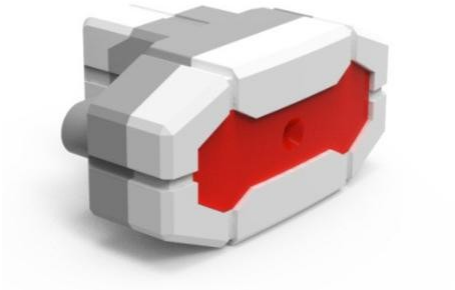
contain:

External sensors: grayscale, collision, ultrasound, Flame, temperature, magnetic sensitivity, photosensitive, humidity, Infrared, color, angle, motor encoder (electric Built-in)

Built-in sensors: sound intensity, gyroscope, timing Device, recording, reading and writing data.

4.1.4.3 **Artificial Intelligence Module Library**

Including: image acquisition, image recognition, two-dimensional code recognition.



4.1.4.3.1 **Image acquisition and image recognition**

This is based on SK The artificial intelligence module of the camera application can identify the color,

The types of building blocks can also be used for face recognition, object recognition and similar situations.

Note: In the case of uniform hardware, the recognition rate depends on the number of samples and the quality of the samples.

Correct the sample to improve the recognition rate.

Image recognition example:

Generally follow the following steps: image acquisition (computer side) -> preliminary correction (computer side) -> image recognition

(Robot side) -> Correct again (computer side).

1) use USB Cable to connect the camera to the computer (the product may be equipped with USBC turn USBA Cable, also

Can use general purpose USBC Cable). At this time, the light of the observation camera is on, indicating that the power supply is normal.

Otherwise, you need to check whether the connection status or cable status is normal.

2) Put the image acquisition module into the programming area and do not connect to the main function.

Open the image acquisition module for debugging. Click to open the camera, at this time the camera image has been obtained (such as

The following figure).

Note that other cameras on the computer (if any) may be turned on at this time, you need to close the image capture

Try to disable other cameras in the test window: Device Manager-Image Devices-select other cameras-right click to disable.

3) Collect the sample. First, adjust the size of the identification frame appropriately, and then enter the sample name in the type setting,

Move or rotate the sample, and click the learn button once for each change.

After a certain amount, change another sample for collection in the same way.

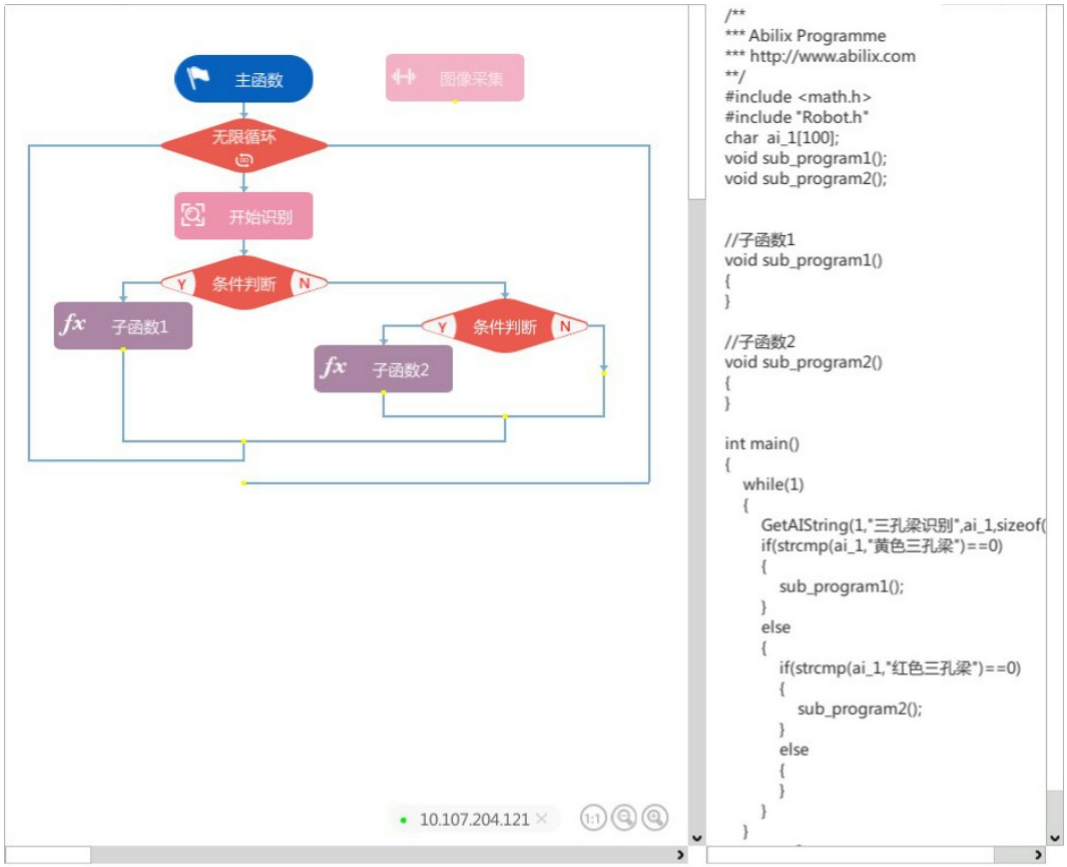
Then remove the sample from the identification box, collect some empty samples and name them.

The collection is complete.

4) Initial correction. At this time, image recognition can be performed in the image acquisition debugging window, and the samples are put into Identify the frame and observe the recognition result. When a recognition error occurs, right-click the index bar and click to view, it will be abnormal The screen is deleted. You can also increase the number of corresponding samples appropriately.

After completion, enter the sample file name and save it for later use.

5) Connect the camera to the controller (USB Interface), put the image recognition module into the programming area and connect to the main Function, you can add some logical judgments and execution actions (except the display module).



When setting the condition, it must correspond to the sample name when the image was collected.

6) Correct again according to the actual situation: first image acquisition, then image recognition.

4.1.4.3.2 **QR code recognition**

Can recognize common QR codes, including QR Code , UPC Equal symbology (based on UTF-8 Character encoding),

Character length is not greater than 100 .

4.1.4.4 **Control module library**

Including: conditional judgment, infinite loop, multiple loop, conditional loop, exit loop, delay.

4.1.4.5 **Calculation module library**

Contains: calculation, advanced calculation, logic, comparison, random number, data classification.

4.1.4.6 **Line Inspection Module Library**

This is a module library specially made for the building block series of line patrol robots with line patrol function as the main function. WER (world

Educational Robot Competition) and its related building blocks are widely used in applications (mainly involving WER Professional Building Block Series

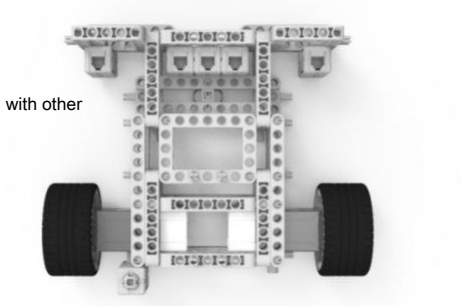
Match, CARC China Association for Science and Technology Education Robot Engineering Challenge, NOC China Audio-visual Education Ability Challenge and other compe

The line inspection module library is suitable for rear drive, 5 Grayscale or set

Grayscale, differential drive robot, except for motion

These modules need to be used in large quantities, and can also be combined with other

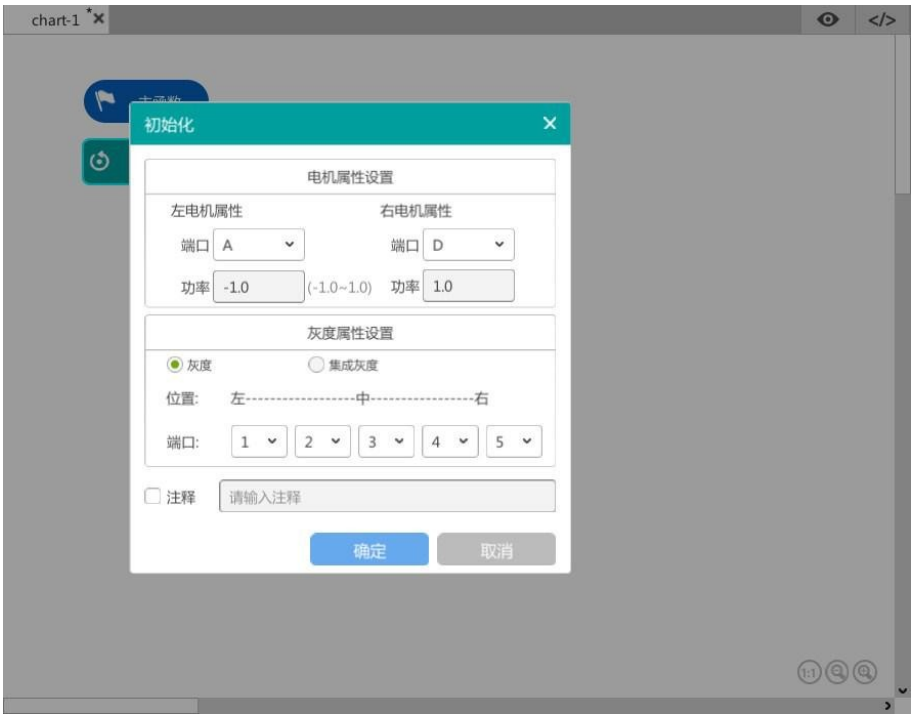
Module library program modules are mixed.



9.1.2.6.1 **initialization**

Set motor attributes and grayscale attributes. Line patrol only

Other modules in the module library work. When designing a competition solution, you usually need to place this module in the program Start position.

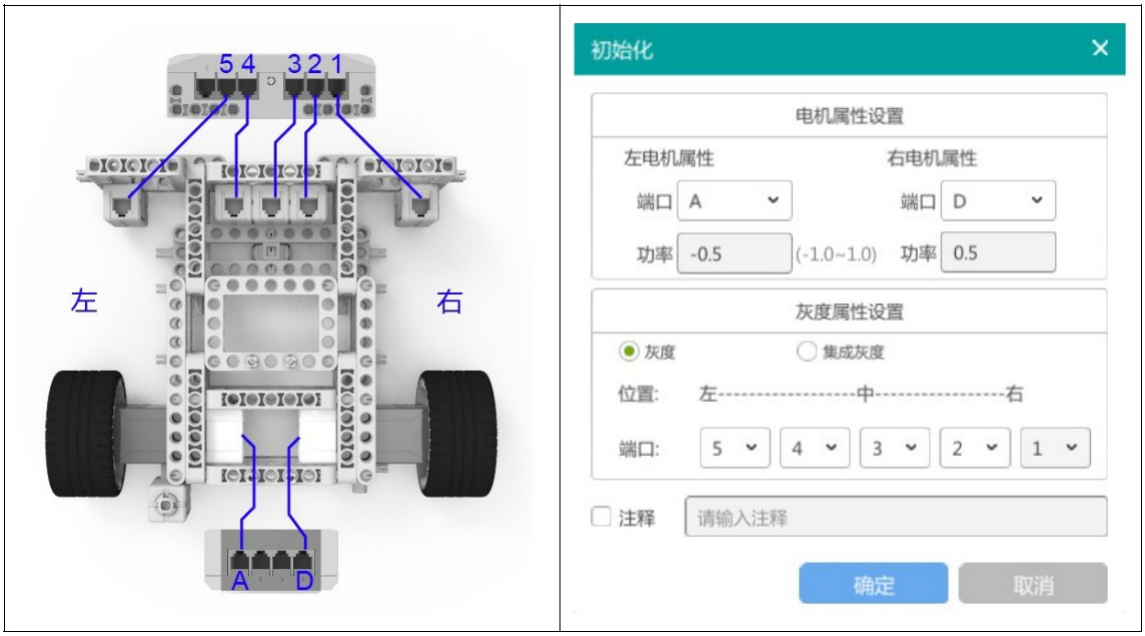


Motor attribute setting: port A~D Single choice, power range- 1.0~1.0 Floating point data.

Gray property setting: Gray indicates that the robot is equipped with a single-channel gray, and the number of sensors is 5 One; integrated gray scale Indicates that the robot is equipped with multi-channel integrated gray scale, and the number of sensors is 1 But integrated 5 Channels.

Position refers to the position of the gray-scale sensor installed in the forward direction of the robot; port refers to the connection of these sensors Connected to SKCON2 On the port.

Reference example:



Note: left motor properties "-0.5" , Which means " Set reverse, power 50%" . Set to reverse to solve the electric

When the machine is turned over and installed, the output ends of the left and right motors rotate clockwise at the same time, causing the robot to rotate counterclockwise o

Like; in the early debugging, the closer the power value 0 , The higher the fault tolerance rate, the value will be close to 1 or

-sIt Tatio speed up the overall

9.1.2.6.2 **Environmental collection**

It is used to calibrate the gray scale sensor value of the robot. Usually when the competition map is used for the first time, or the drawing is generated due to use

It is recommended to use this module when the color changes.

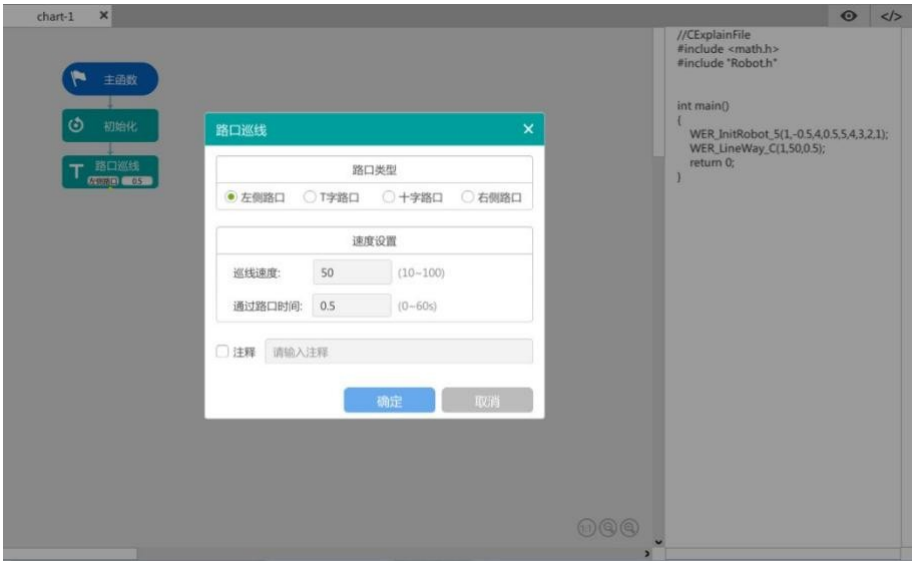
Note: When downloading and running this module program, follow the instructions on the robot screen. The collected values will be stored sequentially

in SKCON9 Data location 11-20 , Where data 11-15 Store the value of the trajectory, 16-20 Store the value of the background. These values

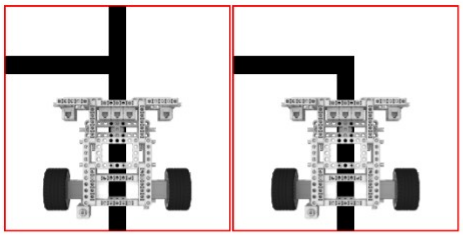
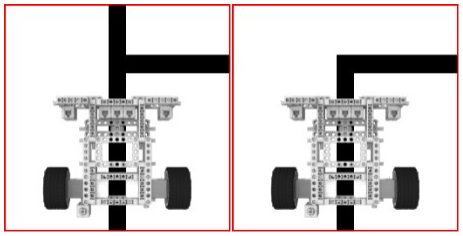
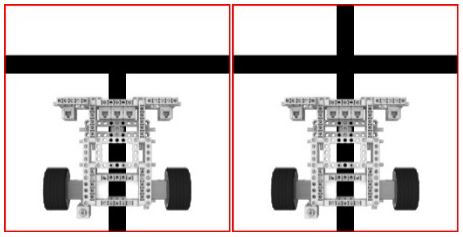
can be modified, and modification should be done with caution.

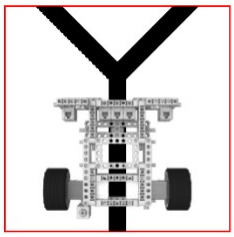
9.1.2.6.3 **Intersection patrol**

Find the module of the intersection by patrolling the line, the intersection type includes: left intersection, T Intersection, intersection, right intersection.



Examples of intersection types:

	Type of intersection: Intersection on the left
	Type of intersection: Intersection on the right
	Type of intersection: The left intersection (when turning left in the next step), or The intersection on the right (when turning right next step), or T Word intersection, Or intersection (when going straight ahead)

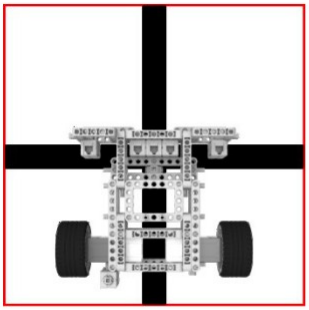
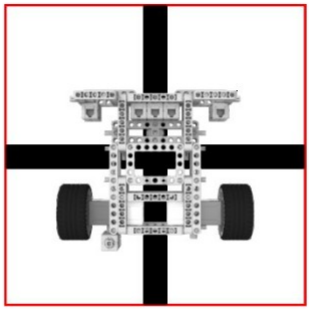
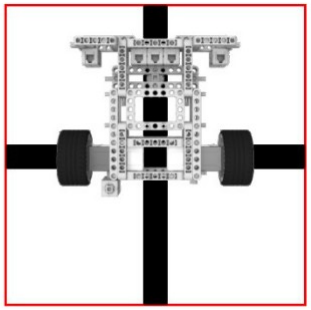
	Type of intersection: The left intersection (when turning left in the next step), Or the intersection on the right (when turning right next step). Note: Do not select T Word intersection or crossroads.

Intersection time: the time to find and pass the intersection, usually 0.0-1.0 Floating point

Data, and the actual operating results, due to " Line inspection speed " It varies from one to another. Note: The quality of the same robot,

The difference in tire friction is ignored, but try to keep the ground and tires clean.

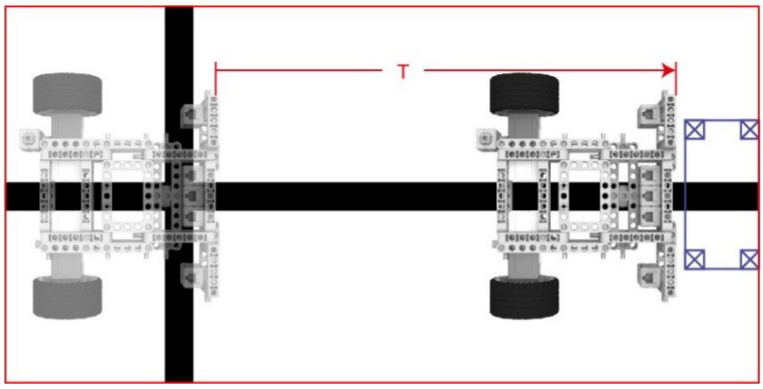
Examples of crossing time:

		
Crossing time (S): 0	Crossing time (S): 0.1	Crossing time (S): 0.2

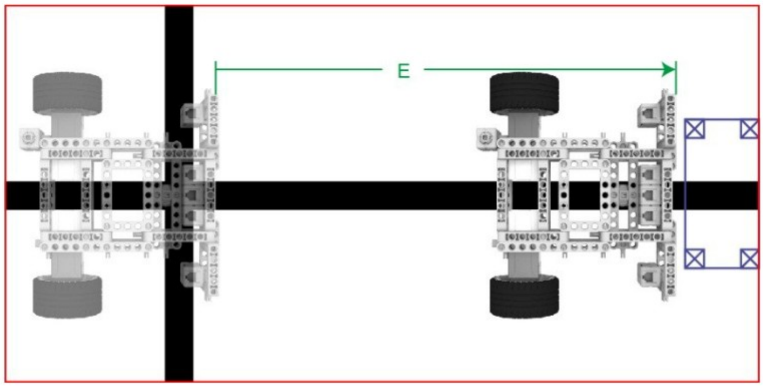
9.1.2.6.4 **Advanced line inspection**

Follow specific conditions to track the line, the conditions include: time value, motor encoder value and sensor value.

Examples of time value conditions:


Time value （S）： 2 Patrol the line until 2 Stop in seconds. Generally used for short-distance rough displacement, it is widely used, but the Remarks: (machine Robot accuracy is not high, and the debugging process needs continuous correction.

Examples of motor encoder values:

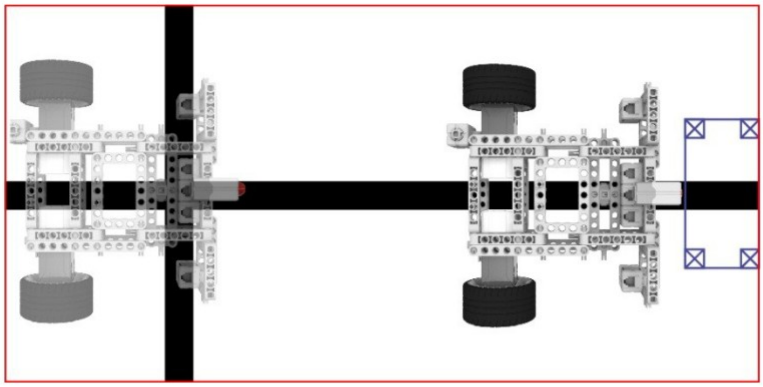


Motor encoder value: left motor, 6400

Remarks: The robot patrols the line until the left motor encoder reading is greater than 6400 Stop when. Mostly used for short-distance precise displacement,

The higher the consistency of the starting position and attitude, the higher the consistency of the stopping position and attitude.

Examples of sensor values:



Sensor value: port 7 (Reading value)= 1

Remarks: Robot patrols the line until the port 7 equal 1 (That is, the collision is pressed) to stop. It is also applicable when the sensor type is grayscale,

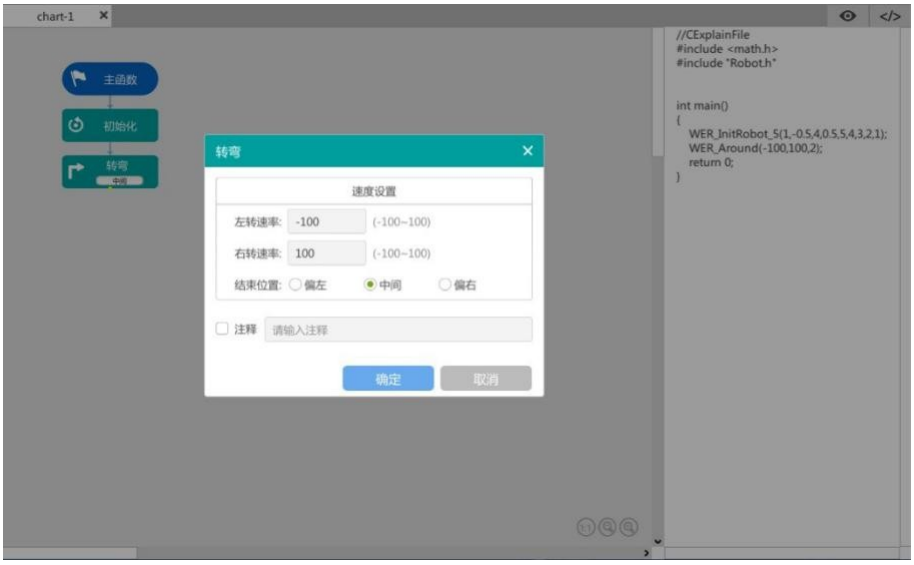
infrared and other analog input data. Used in specific scenarios. In the example, the target position is simulated

A project model fixed on the field, the collision of the robot in the forward direction, the robot will encounter the project model

Type so that the corresponding port (7) The reading is determined by 0 Becomes 1 , Which triggers the condition, and finally achieves the purpose of displacement.

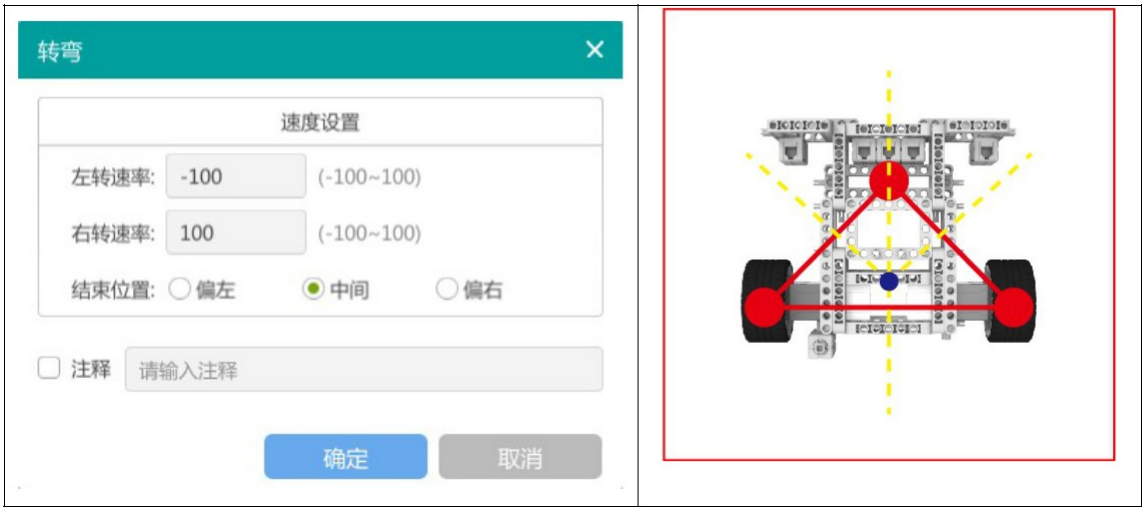
9.1.2.6.5 **Turn**

Through the different steering of the left and right motors, and determine the gray return value in turn, the robot turning action is completed.

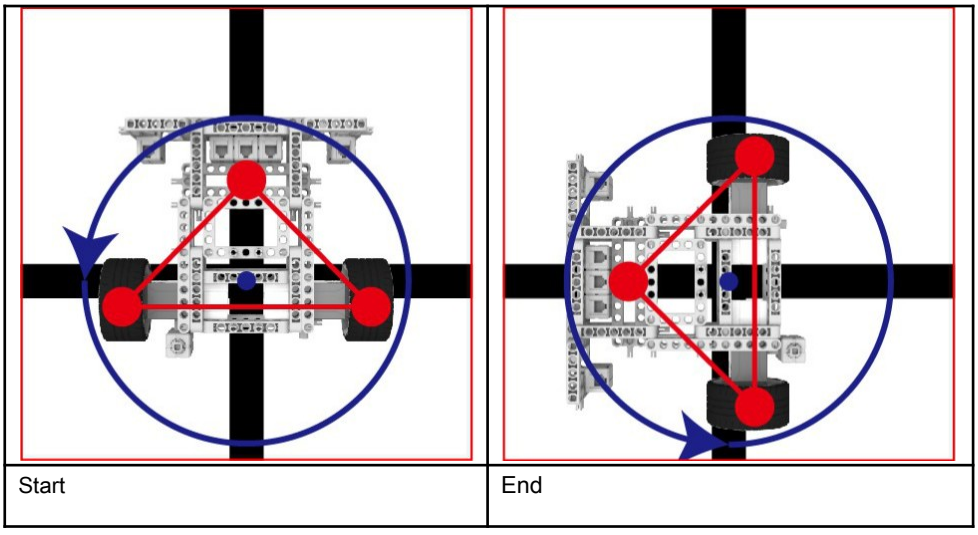


Robot turning mode, there are 3 This is achieved by controlling the speed of the left and right motors, taking left turn as an example:

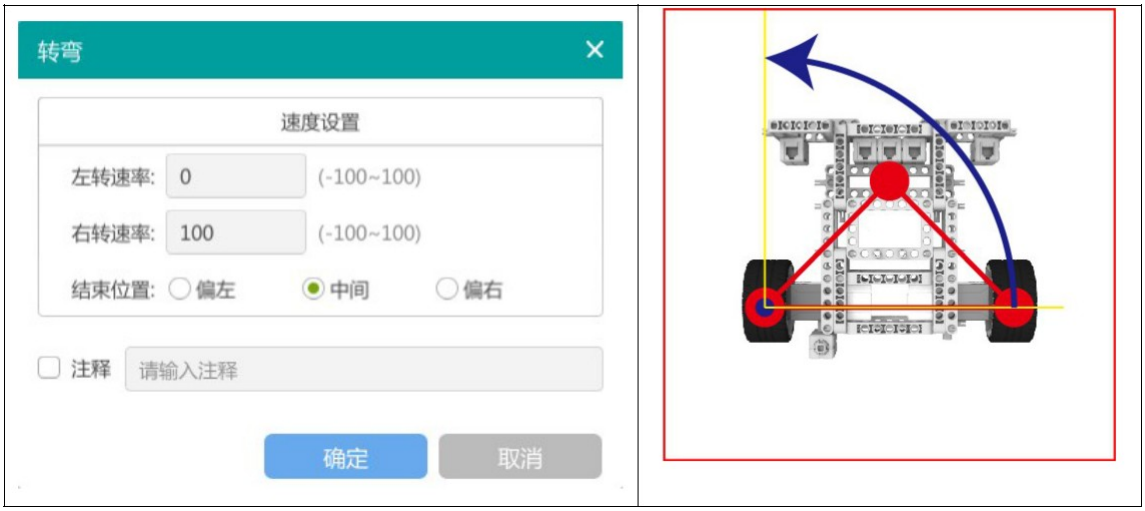
Turn examples a) : Turn left (the left wheel moves backward, the right wheel moves forward)



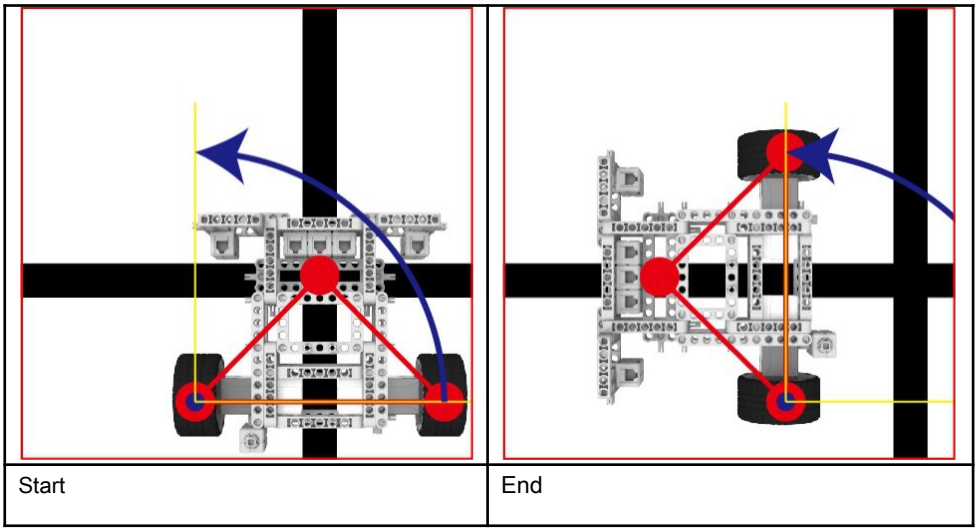
This method is widely used and easy to understand. Features, small turning radius.



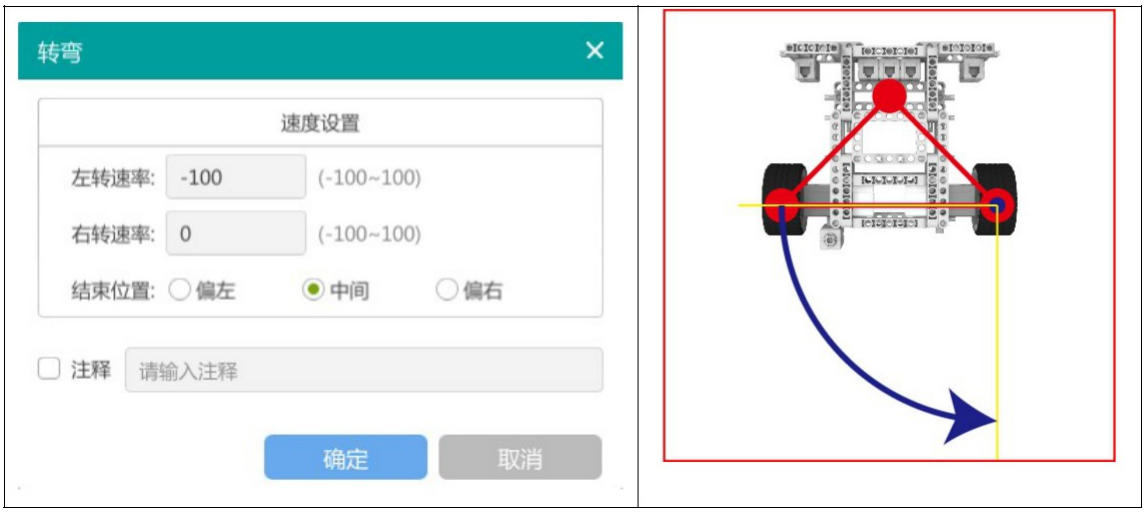
Turn examples b) : Turn left (the left wheel stops, the right wheel moves forward)



This method is special and has fewer applications. Features, large turning radius.

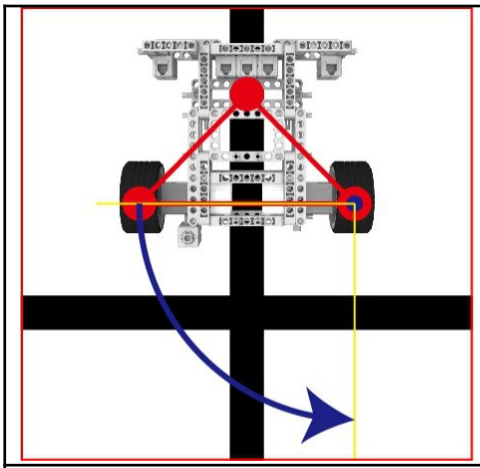
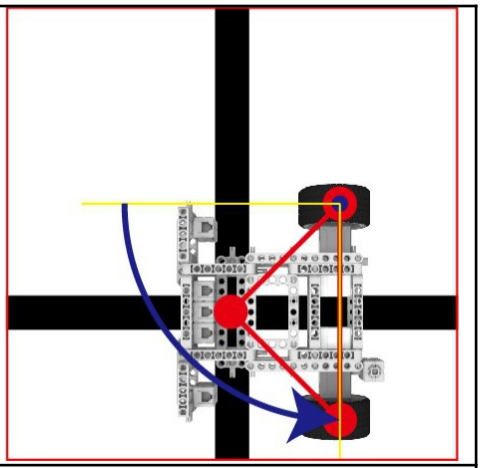


Turn examples c) : Turn left (the left wheel moves back, the right wheel stops)

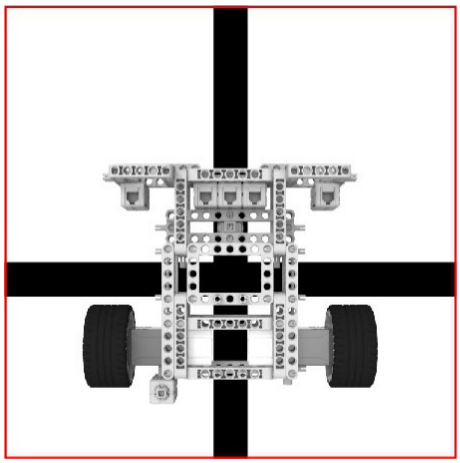
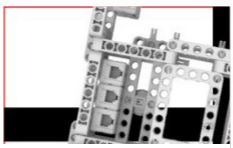
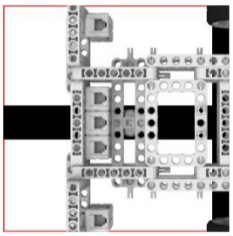
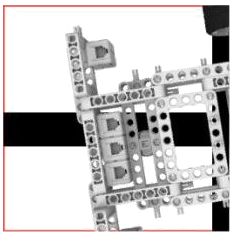


This method is also special, and the characteristic is also a large turning radius, but the advantage is that it leaves a longer distance after turning.

The trajectory is used for posture correction.

	
Start	End

At the end of the turn 3 Kind, take a left turn as an example:

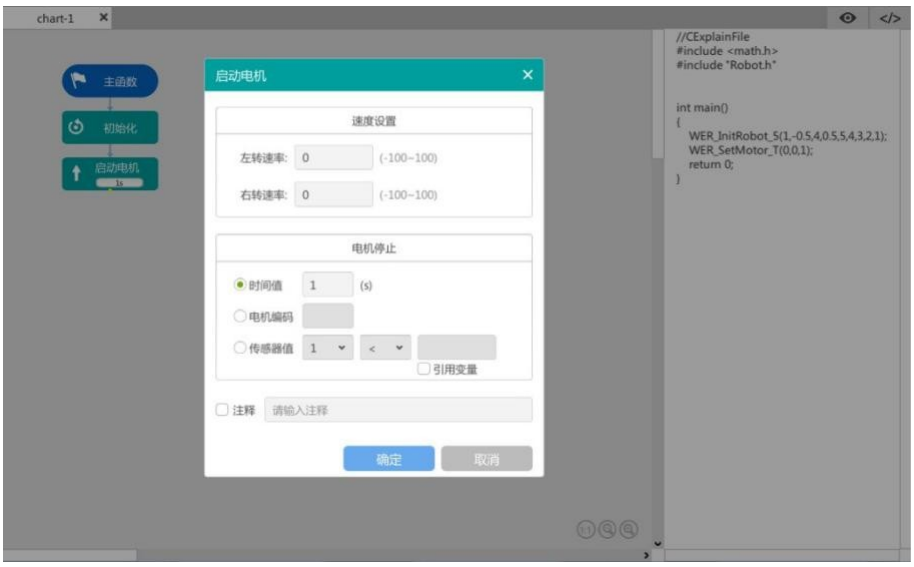
		Left
		intermediate
		Right
Start	End	End position

Note: When the mass is constant, the greater the speed, the greater the inertia. " End position " The actual stop position must be affected by inertia It is different, so this function needs to be applied flexibly.

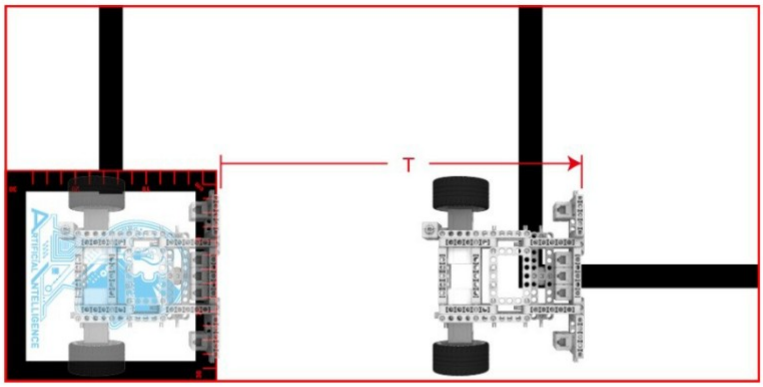
9.1.2.6.6 **Start the motor**

Start the motor through specific conditions, including: time value, motor encoder value and sensor value.

The applicable displacement method can be straight line, curved line, forward and backward.



Examples of time value conditions:

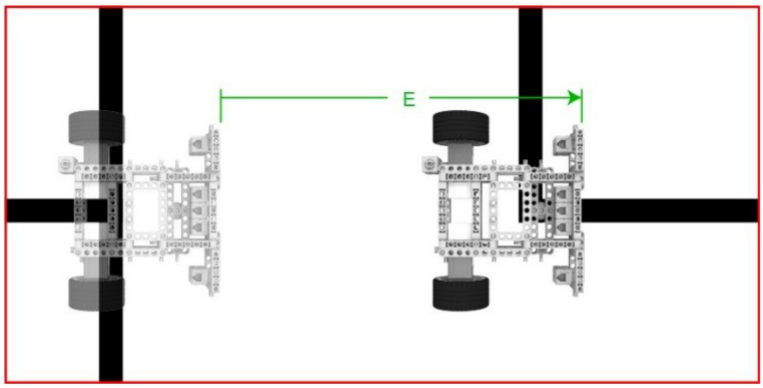


Revolver speed: 20 , Right wheel speed: 20 , Time value (s)： 2 Rough displacement in short distance, widely used, but the accuracy is not

Note: The robot starts until 2 Stop in seconds. One General use

High, the debugging process needs constant correction, usually slow speed.

Examples of motor encoder values:

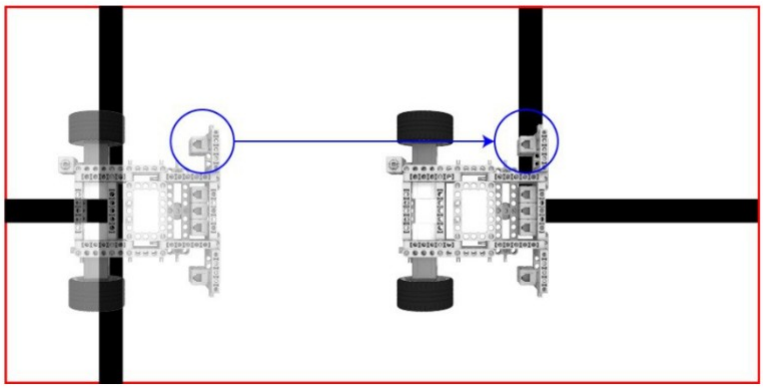


Revolver speed: 100 , Right wheel speed: 100 , Motor encoder value: left motor, 6400

Note: The robot starts until the left motor encoder reading is greater than 6400 Stop when. Mostly used for short-distance precise displacement,

The higher the consistency of the starting position and attitude, the higher the consistency of the stopping position and attitude.

Examples of sensor values:


Sensor value: port 5 (Reading value) 25 0 Value is greater than 2500 (That is, when the grayscale detects the track), it stops. When sensing Remarks trol the device until the end>mouth return 0 Back to It is also applicable when the device type is analog input such as infrared or digital input data such as magnetic sensitivity and collision. Used for specific Scenes. In the example, the start position port is simulated 5 Light-colored ground is detected, after the robot moves forward, the port 5 detected Trace so that the corresponding port (5) The return value is determined by < 2500 Becomes> 2500 , Which triggers the condition and finally reaches the displacement the goal of.

4.1.4.7 **Function module**

Create new functions, tasks, returns, and customize.

4.1.4.8 **Other modules**

It is added as the software version iterates.

4.2 Abilix Scratch 3.0

Stay tuned!

5 to sum up

Now you have mastered SKCON9 Operation method, open the programming software, design your robot program

Right! You can also combine the building blocks provided by Ability Storm to create your own robot project! More chance to participate WE R

World Educational Robot Competition (Visit wergame.org Online Registration)!

(WER WeChat public account) (WER FACEBOOK)

5.1 Technical support and service

You can visit the official website of Ability Storm www.abilix.com ,in " Technical Service/Data Download " Get the latest

Please pay attention to the product instructions.

If you encounter problems during use, or have suggestions for product improvement, you are welcome to contact us. Contact information:

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