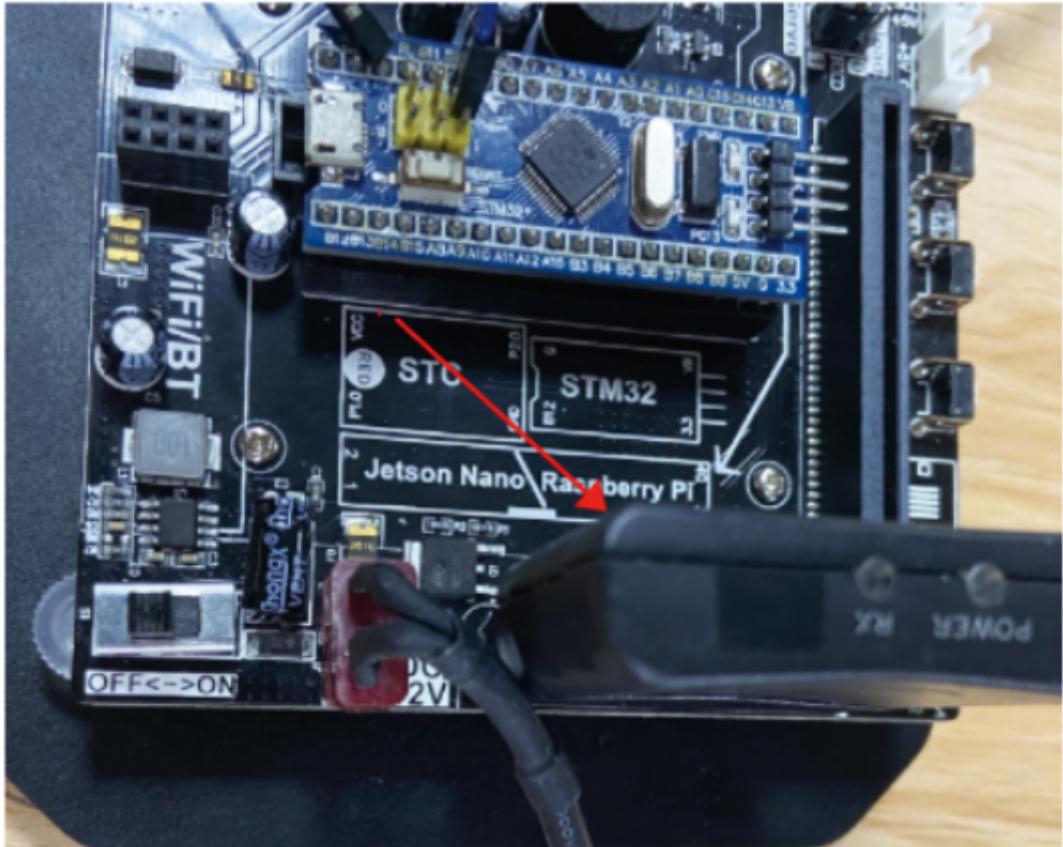


First Trial

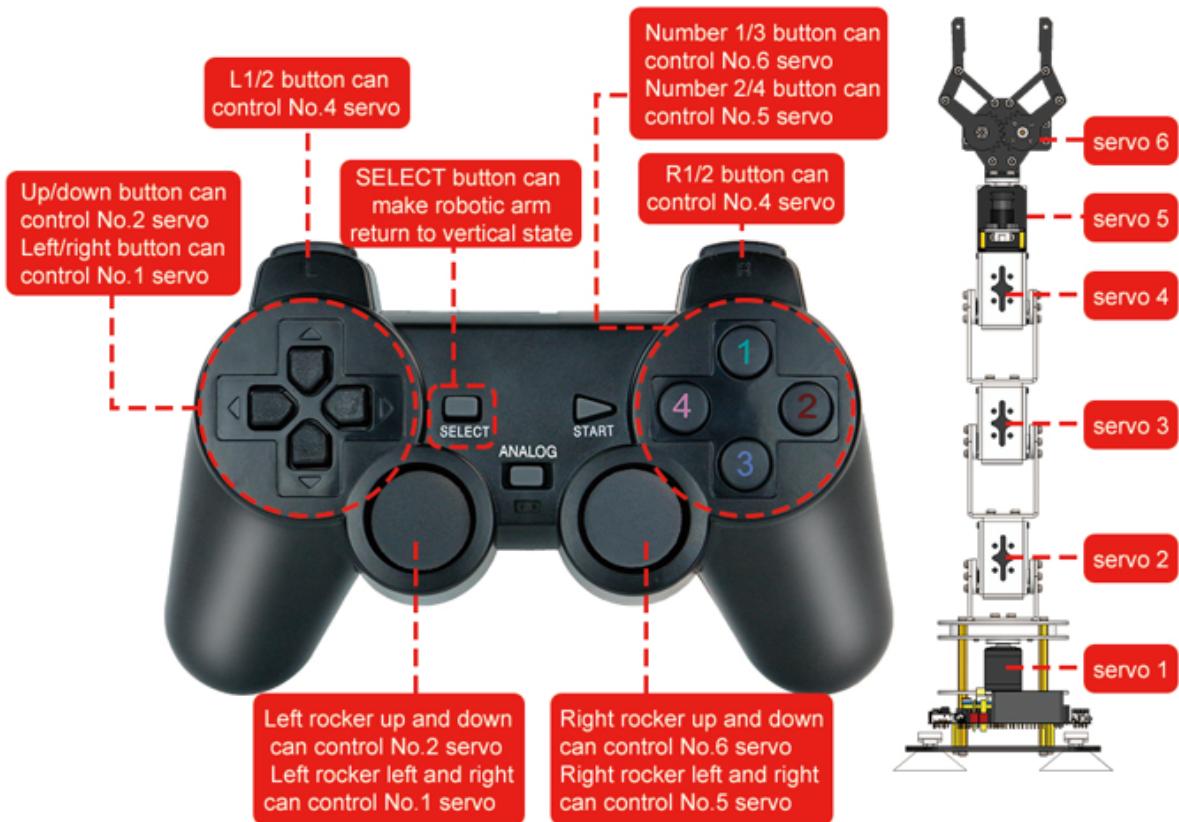
1. PS2 handle control

Insert the receiver of the handle onto the robotic arm extension board, as shown below



Handle control:

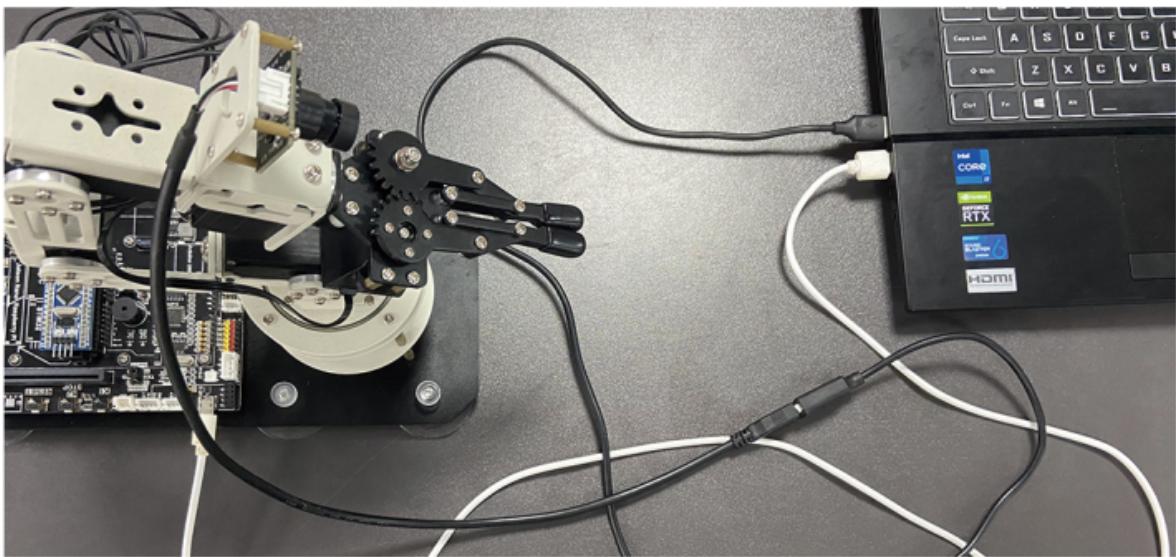
Start the robotic arm, turn on the handle switch, and the handle and receiver will automatically pair. You can use the handle to control the joints of the robotic arm. The following are the corresponding functions of each button on the handle.



2. APP control

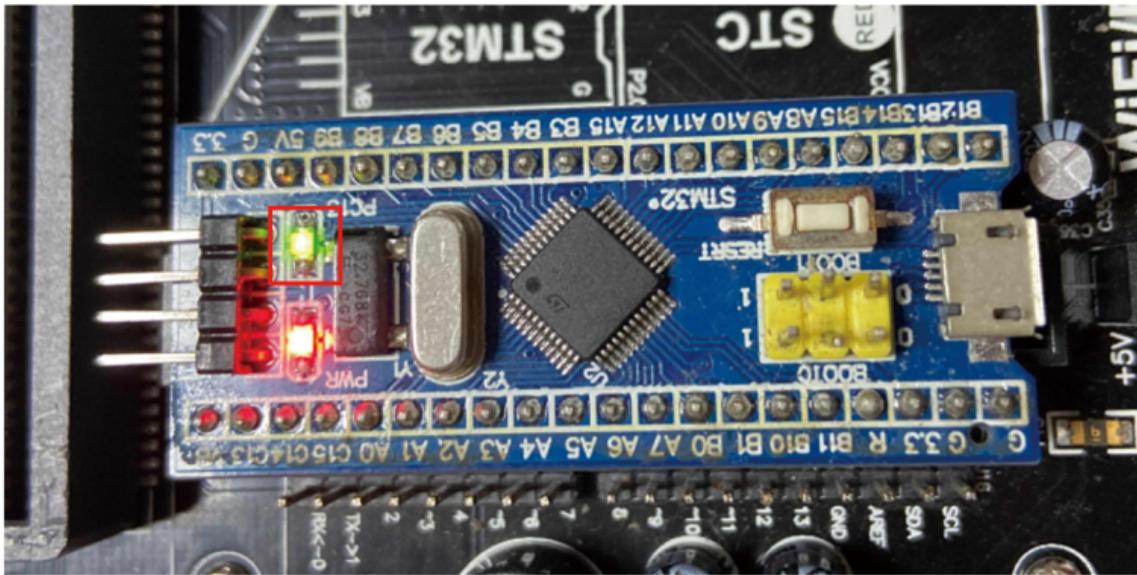
2.1 Dofbot-SE wiring and start up process

- Connect camera to computer by USB extension line, as shown below on the left.
- Connect Dofbot-SE expansion board to computer by Micro USB cable, as shown below on the middle and right.



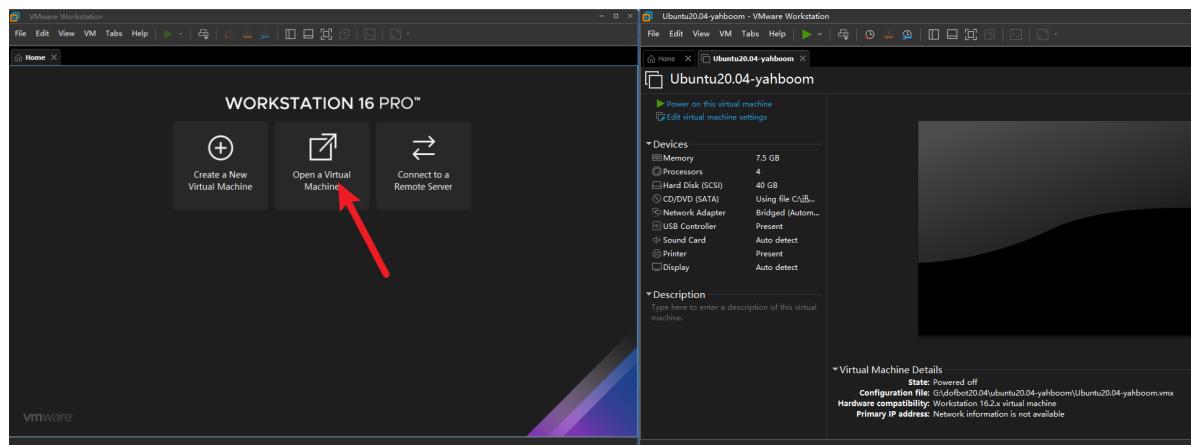
Plug the STM32 core board into the Dofbot-SE expansion board and turn on the power switch. If the yellow-green LED light on the STM32 core board flashes every second, it means that the factory firmware has been successfully loaded. As shown below.

If yellow-green LED indicator light does not light up, please contact technical support for consultation on re-writing the firmware into STM32 core board.

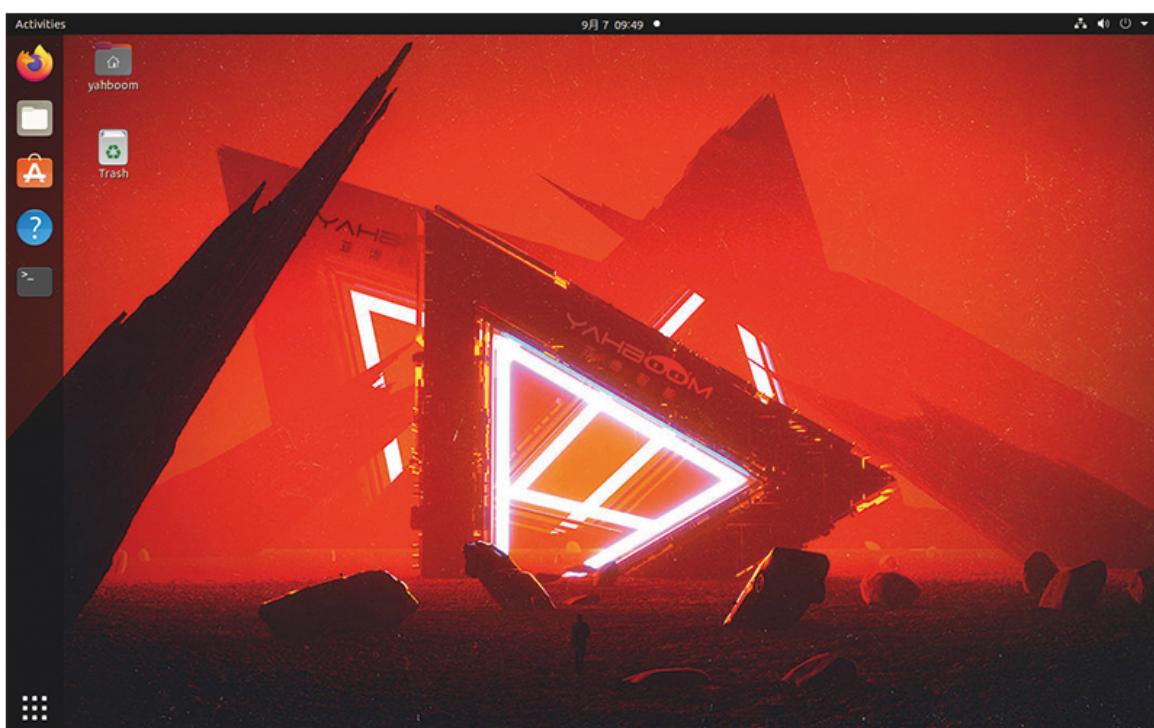


Open the virtual machine file provided by Yahboom.

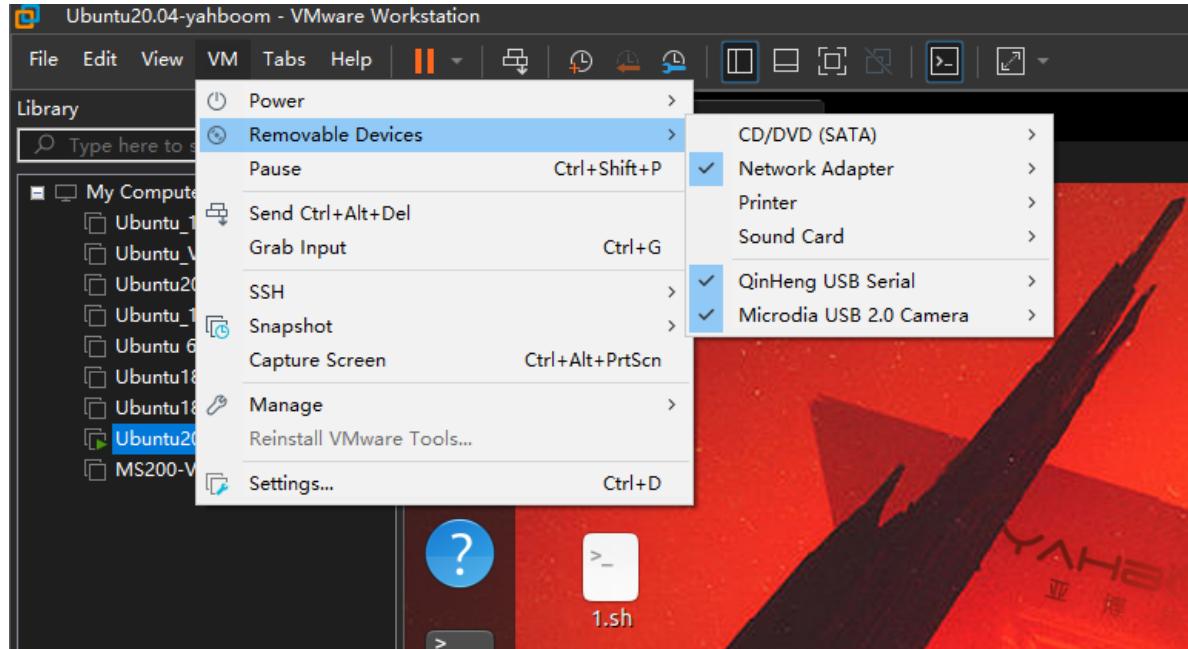
VM login password: yahboom



After successfully opening the virtual machine, you can see the screen as shown below.



As shown below, we need connect the camera cable and Micro USB cable to the virtual machine system.



Open the terminal and run following command to start up control process. If you hear the buzzer beep three times, it means the control process has started successfully.

```
python3 rosmaster/YahboomArm.py
```

```
/home/yahboom/catkin_ws/src/arm_info/launch/arm_kin.lau...
process[kin-1]: started with pid [2711]
等待接收*****
Fusing layers...
pygame 2.5.0 (SDL 2.28.0, Python 3.8.10)
Hello from the pygame community. https://www.pygame.org/contribute.html
[['calibrateThreshold]\n', 'g_calibratethreshold = 99\n', '\n', '[HSV]\n', 'g_hs
v_red = 0, 160, 198, 181, 255, 255\n', 'g_hsv_green = 50, 72, 126, 74, 255, 255
\n', 'g_hsv_blue = 106, 176, 115, 118, 255, 255\n', 'g_hsv_yellow = 20, 102, 223,
28, 255, 255\n', '\n', '[calibrateXY]\n', 'g_calibratexy = 93, 133\n', '\n']
99
[93, 133]
[0, 160, 198, 181, 255, 255]
[50, 72, 126, 74, 255, 255]
[106, 176, 115, 118, 255, 255]
[20, 102, 223, 28, 255, 255]
[ WARN:0] global ../modules/videoio/src/cap_gstreamer.cpp (935) open OpenCV | GS
treamer warning: Cannot query video position: status=0, value=-1, duration=-1
[ WARN:0] global ../modules/videoio/src/cap_gstreamer.cpp (1186) setProperty Ope
nCV | GStreamer warning: GStreamer: unhandled property
[ WARN:0] global ../modules/videoio/src/cap_gstreamer.cpp (1186) setProperty Ope
nCV | GStreamer warning: GStreamer: unhandled property
* Serving Flask app 'YahboomArm'
* Debug mode: off
```

Open another terminal window and enter the following command to view the current IP address of the virtual machine. If you need to connect to the mobile APP, you need to enter the queried IP address.

Note: The virtual machine and phone need to be connected to the same network.

```
ifconfig
```

```

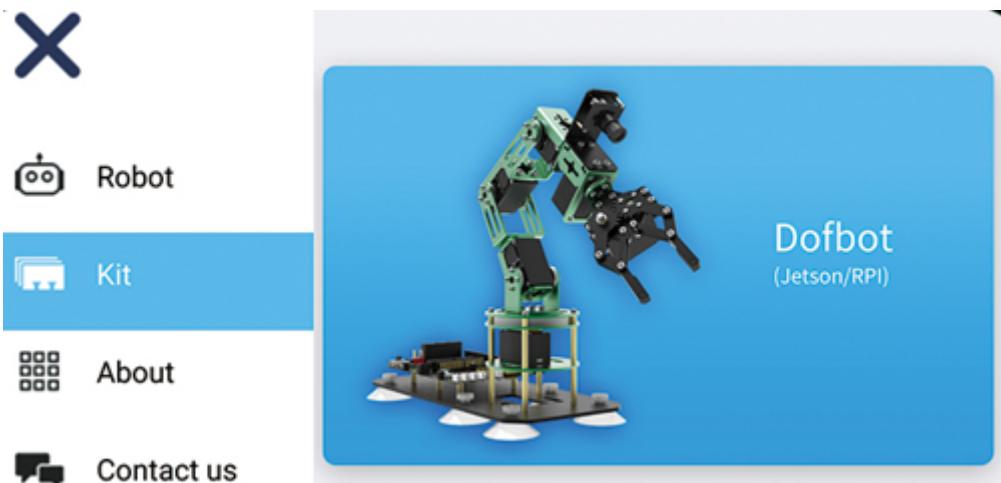
/home/yahboom/catkin_ws/src/arm_i... x      yahboom@yahboom-virtual-machine: ~ x
yahboom@yahboom-virtual-machine:~$ ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
      inet 192.168.2.108  netmask 255.255.255.0  broadcast 192.168.2.255
      inet6 fe80::1193:35bd:37b8:4efb  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:a4:51:36  txqueuelen 1000  (Ethernet)
          RX packets 11246  bytes 1428316 (1.4 MB)
          RX errors 0  dropped 2  overruns 0  frame 0
          TX packets 536  bytes 48098 (48.0 KB)
          TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
      inet 127.0.0.1  netmask 255.0.0.0
      inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
          RX packets 787  bytes 127140 (127.1 KB)
          RX errors 0  dropped 0  overruns 0  frame 0
          TX packets 787  bytes 127140 (127.1 KB)
          TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

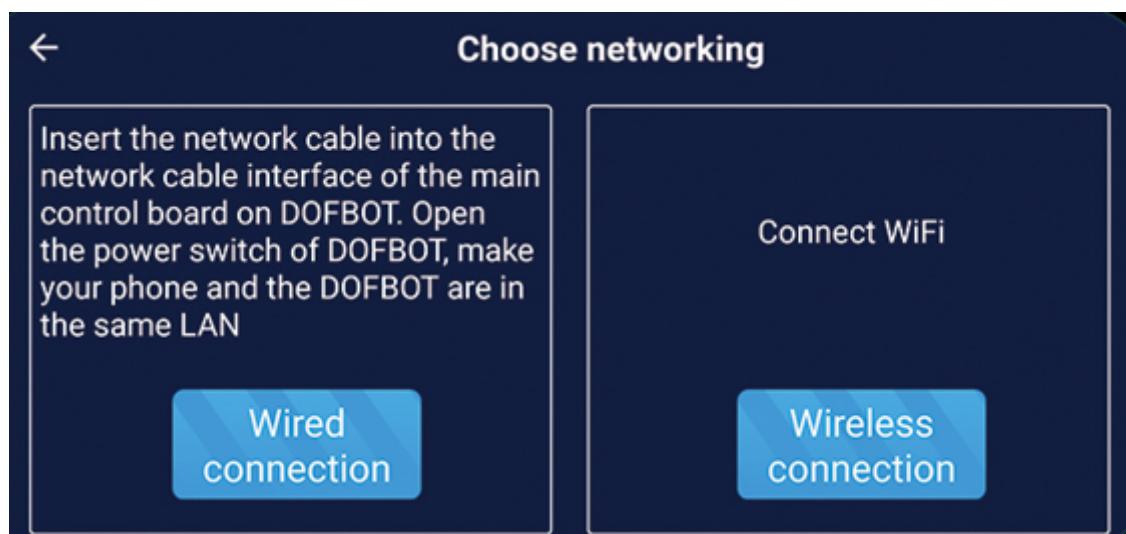
yahboom@yahboom-virtual-machine:~$
```

2.2 Connect network and calibration

1. Open YahboomRobot APP, choose [Kit]--[DOFBOT].

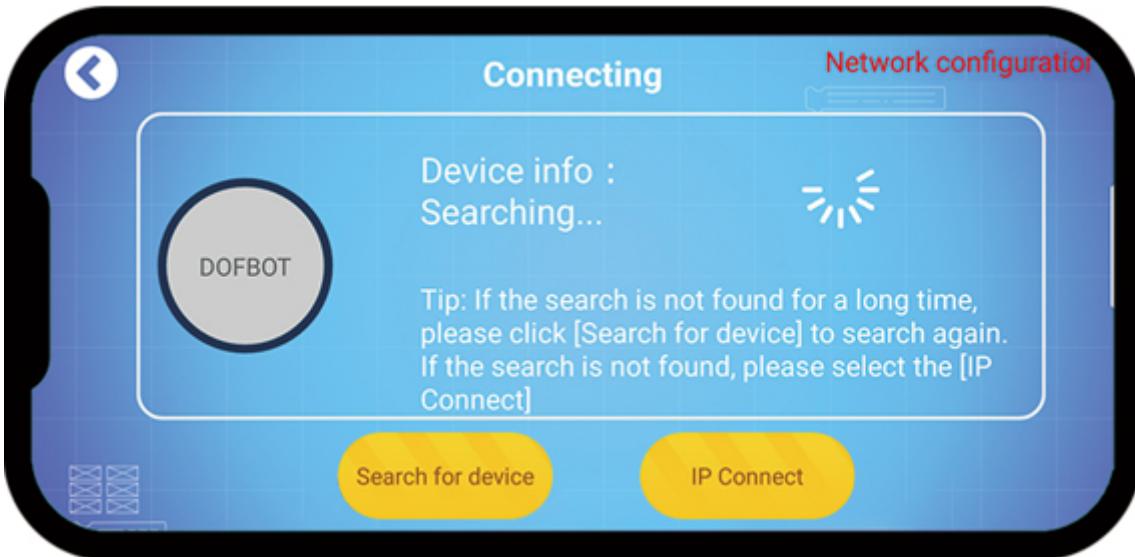


2. Select the network connection method [Wired Connection]. The Dofbot-SE version does not support [Wireless Connection]



3. The phone will automatically search for the device, and a prompt info will appear after a few seconds, click [Connect] If the device is not found for a long time,

please click [Search for device] to search again.



4.We can also click the [IP Connect] to connect to the network manually. As shown below, input DOFBOT IP address on APP, "Port":6000 , "video": 6500.



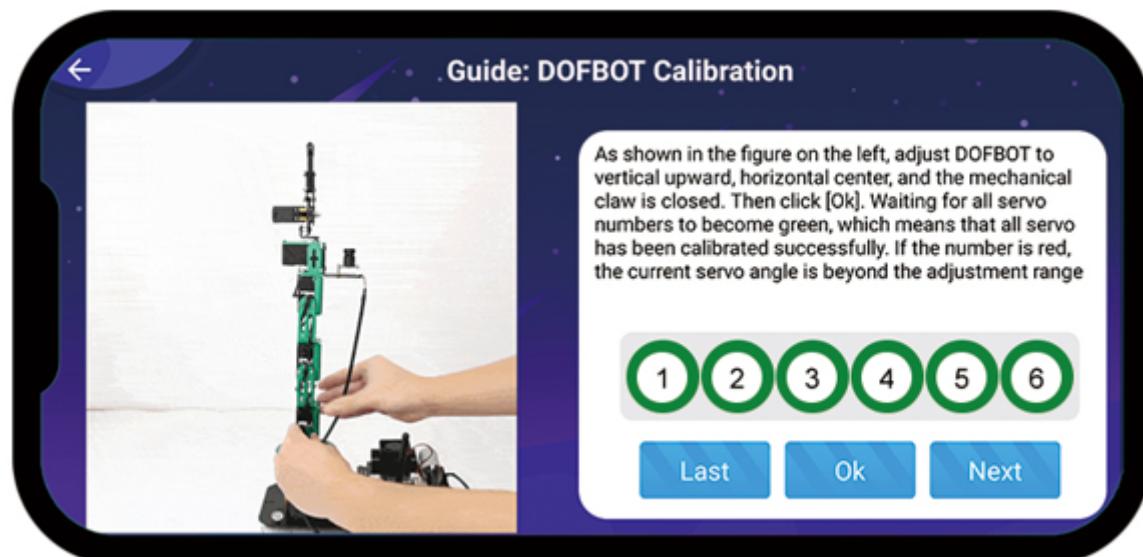
5.Guide: DOFBOT calibration. All servos must be calibrated before DOFBOT is used, otherwise it will not work properly.

Press the [Middle] button to check whether DOFBOT is in the state of vertical upward, horizontal center, and the mechanical claw is closed.

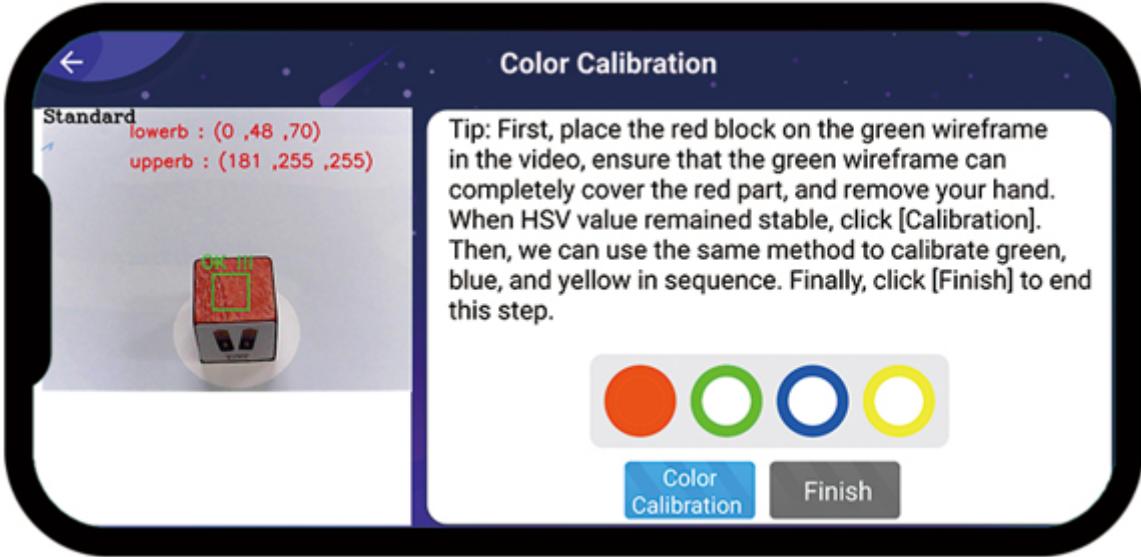
If it is normally, please click the [Skip], otherwise, we need the click[Calibrate] button to calibrate each servo.



6. After clicking [Calibrate], DOFBOT will enter the calibration state. Check whether the DOFBOT is in the state of vertical upward, horizontal center, and the mechanical claw is closed. After the adjustment is completed, click [Ok]. If the circle around numbers from blue to green, it means all servos are calibrated successfully, click [Next].



7. Guide: Color calibration. Place the red block on the green wireframe in the video, ensure that the green wireframe can completely cover the red part, and remove your hand. When HSV value remained stable, click [Color Calibration]. Then, we can use the same method to calibrate green, blue, and yellow in sequence. Finally, click [Finish] to end this step.

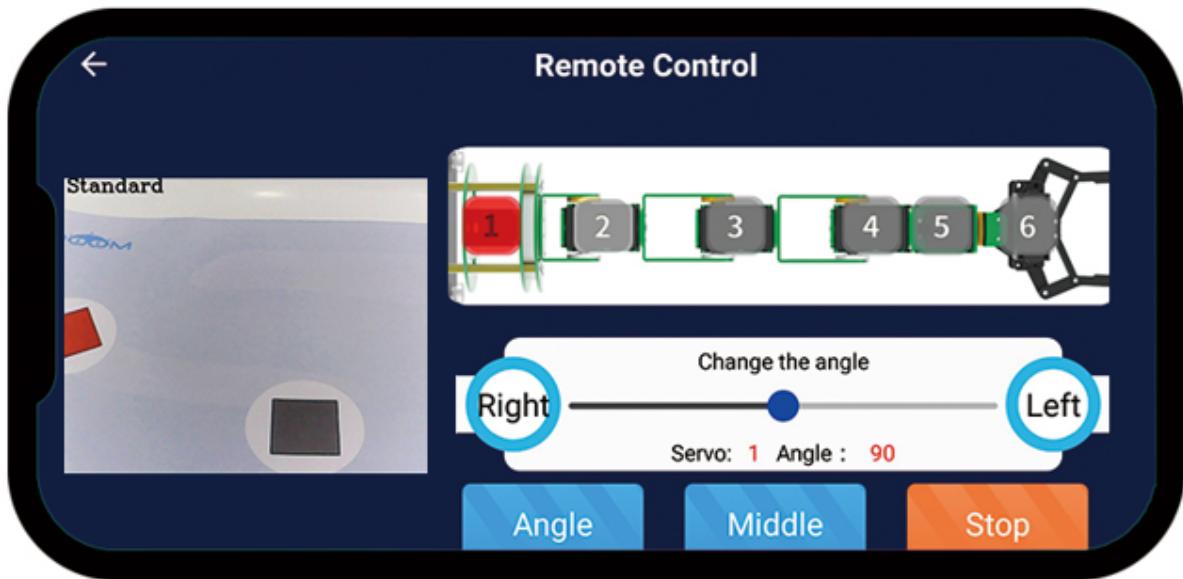


3. APP function

1. Remote Control



Click the [Remote Control] icon, the following interface will appear on APP.



The camera screen is displayed on the left side of the APP. The numbers 1 to 6 on the schematic diagram of the DOFBOT represent the six servos. When we select the servo with the current ID number, the corresponding number will become red. Then, we can adjust the angle of the servo by dragging the slider or pressing left and right buttons.

[Angle]: After clicking this button, the APP will read the current servo angle, and update angle value to the upper slider.

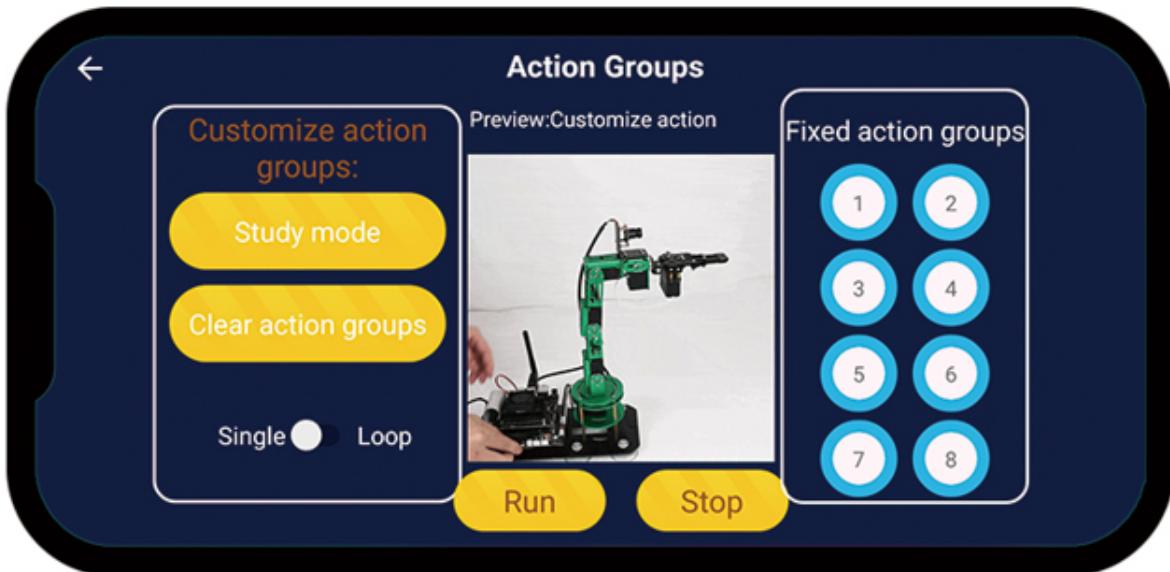
[Middle]: DOFBOT returns to initial state.

[Stop]: Click this button, torque of the DOFBOT will be closed and stop receive control commands. We can manually control the angle of the servo. Click this button again, torque of the DOFBOT will be opened, it will return to initial state. And it starts receive control commands.

2.Action Group



Click the [Action Group] icon, the following interface will appear on APP.



[Run]: DOFBOT runs the current action group.

[Stop]: DOFBOT stops all actions.

[Customize action groups]: Make the DOFBOT learn some action groups. Click [Study mode], a prompt info will pop up, and the RGB light on the extension board will become blue breathing light.

Click [Record X Action] button, the DOFBOT will record the current posture as an action group, and the RGB light breathing light on the expansion board will change to another color, which indicating that this action has been recorded.

After recording multiple sets of actions, click [Completed] to exit this mode, and RGB light on the expansion board will go out.

If RGB light is red breathing light, it means that the study mode is wrong or the recorded action group is full (up to 20 actions are stored), click [Completed] button to exit.

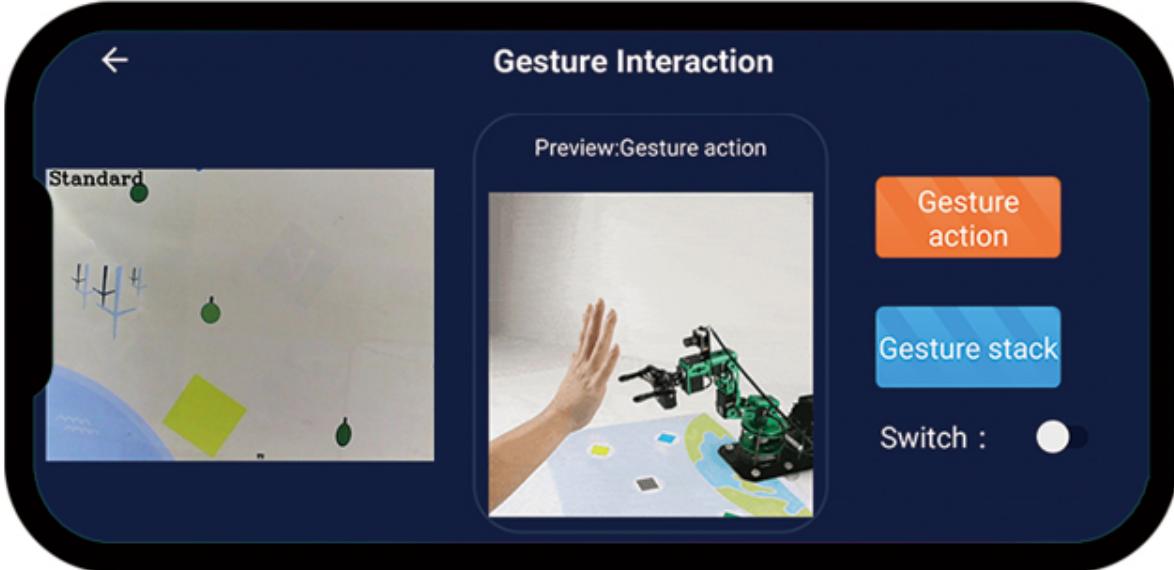
[Fixed action group]: Click the different number buttons to view the function of the corresponding action group from the preview window.

When you click [Run], DOFBOT will run the action group corresponding to the current number.

3.Gesture Interaction



Click the [Gesture Interaction] icon, the following interface will appear on APP.



Gesture interaction includes gesture action and gesture stack.

After selecting the corresponding function, click [Switch] to open this function, we can see recognized gestures the on preview window. Click [Switch] again to closed this function.

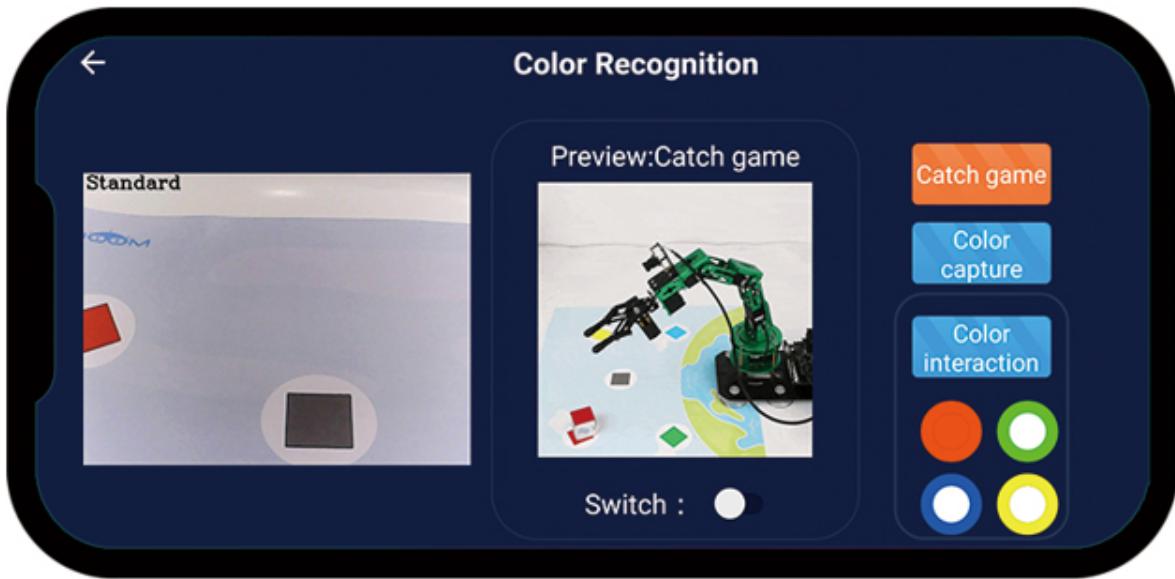
[Gesture action]: Recognize some gestures and perform corresponding actions.

[Gesture stack]: Recognize gesture 1,2,3,4, pick up yellow, red, green, and blue blocks respectively and stack them in order. When the fist is recognized, push down all blocks and the recognition data is reset.

4. Color recognition



Click the [Color recognition] icon, the following interface will appear on APP.



Color recognition includes catch game, color capture and color interaction;

After selecting the corresponding function, click [Switch] to open this function, we can see recognized gestures the on preview window. Click [Switch] again to closed this function.

[Catch game]: Place the block in the area recognized by the camera, DOFBOT will automatically recognize the currently color, and catch the block and put it in the area of the corresponding color on map.

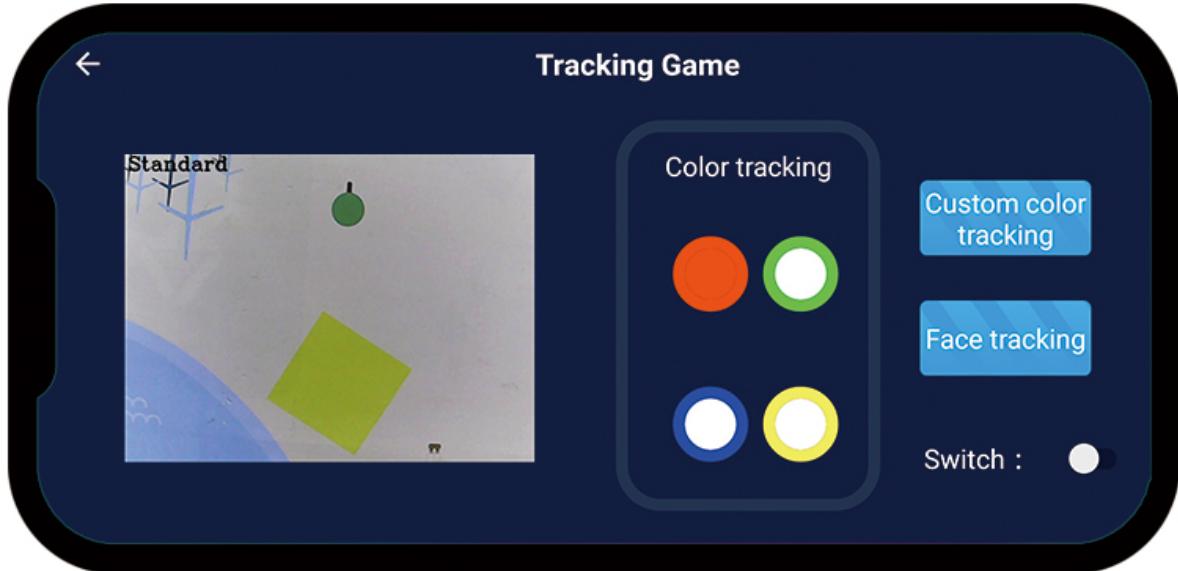
[Color capture]: Place the block on the camera, after DOFBOT recognizes the color of the block, it catch the block from the corresponding color area to the middle area on map.

[Color interaction]: After selecting the color below, then, open the play switch and place the blocks of the corresponding color in front of the camera of DOFBOT. It will imitate the movement of the snake. The specific phenomenon can be viewed on the preview window.

5.Tracking game



Click the [Tracking game] icon, the following interface will appear on APP.



Color recognition includes color tracking, custom color tracking and face tracking;

After selecting the corresponding function, click [Switch] to open this function, we can see recognized gestures the on preview window. Click [Switch] again to closed this function.

[Color tracking]: Select the color on APP, open the switch, and put the block of the corresponding color in front of the camera, move the block, DOFBOT will move with the block.

[Custom color tracking]: Click this button, it will display a box on camera video, place the block in the area recognized by the camera. After accurately obtaining the color of the block, open the switch, DOFBOT will move with the block.

[Face Tracking]: If a face is detected, DOFBOT will mark it and move with the face.

6. Garbage Sorting



Click the [Garbage Sorting] icon, the following interface will appear on APP.



Open the switch and the system will automatically load the model. After the red prompt [Model-Loading] in the video disappears, place the block with the garbage picture in the area recognized by the camera.

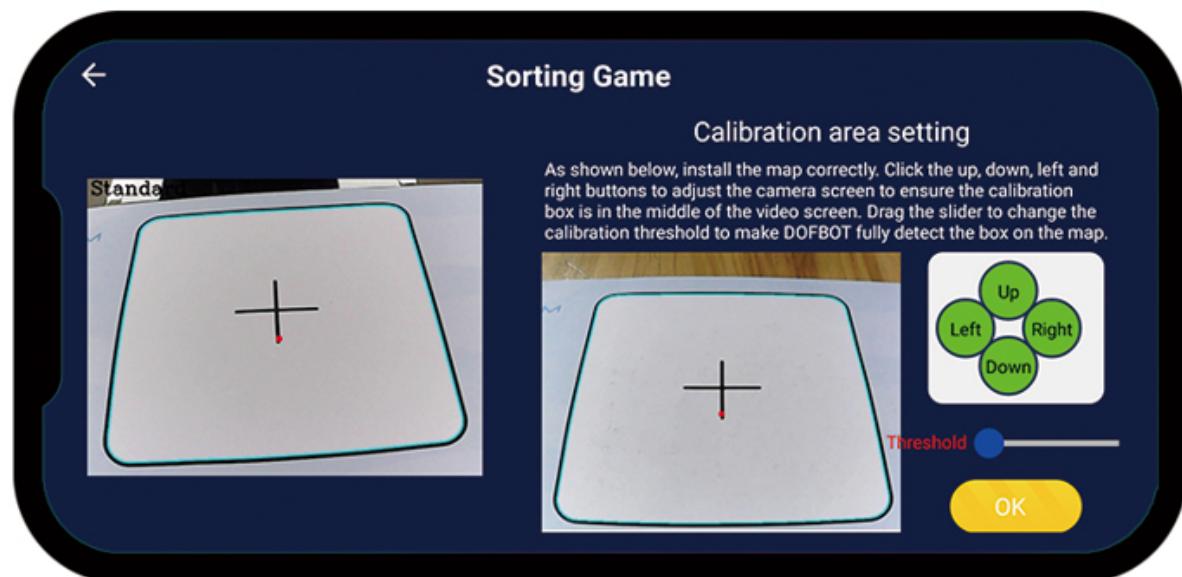
DOFBOT can identify the type of garbage on the current block and display result on the APP.

After the same garbage is recognized 10 times continuously, DOFBOT will sort it to the corresponding location on the map according to the garbage category.

7. Advanced Setting(Beta)



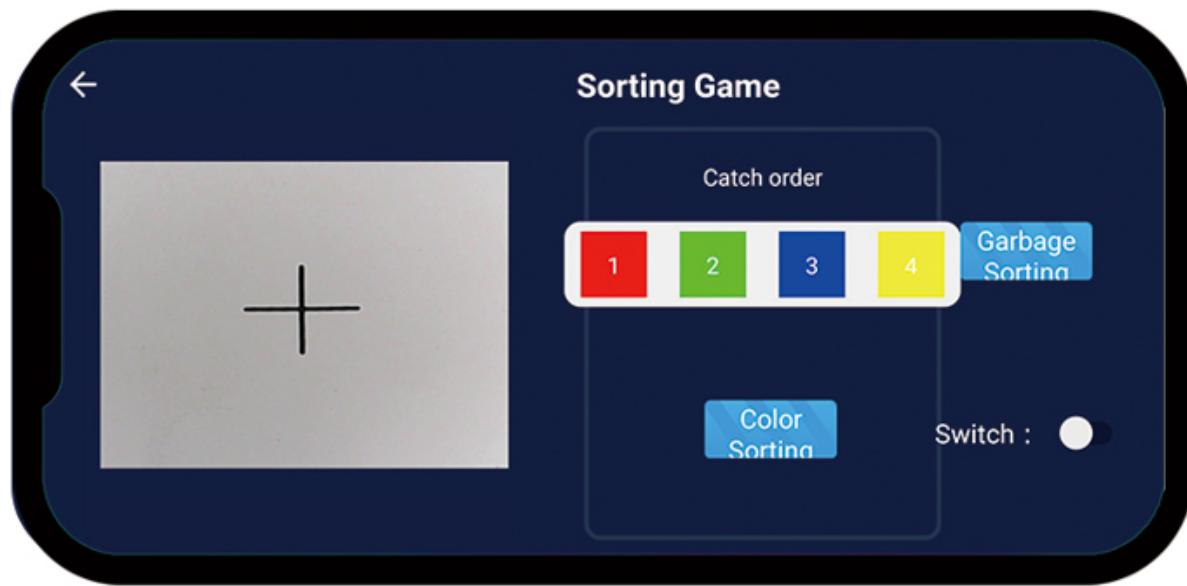
Click the [Advanced Setting(Beta)] icon, the following interface will appear on APP.



Pressing [Up, Down, Left, Right] buttons to move the DOFBOT to make the frame appears completely in the field of view.

Then, slide the slider of [Threshold] to adjust the frame detection threshold until the four sides of the frame are completely detected. as shown above.

Click [Ok] to enter the [Sorting Game] interface, as shown below.



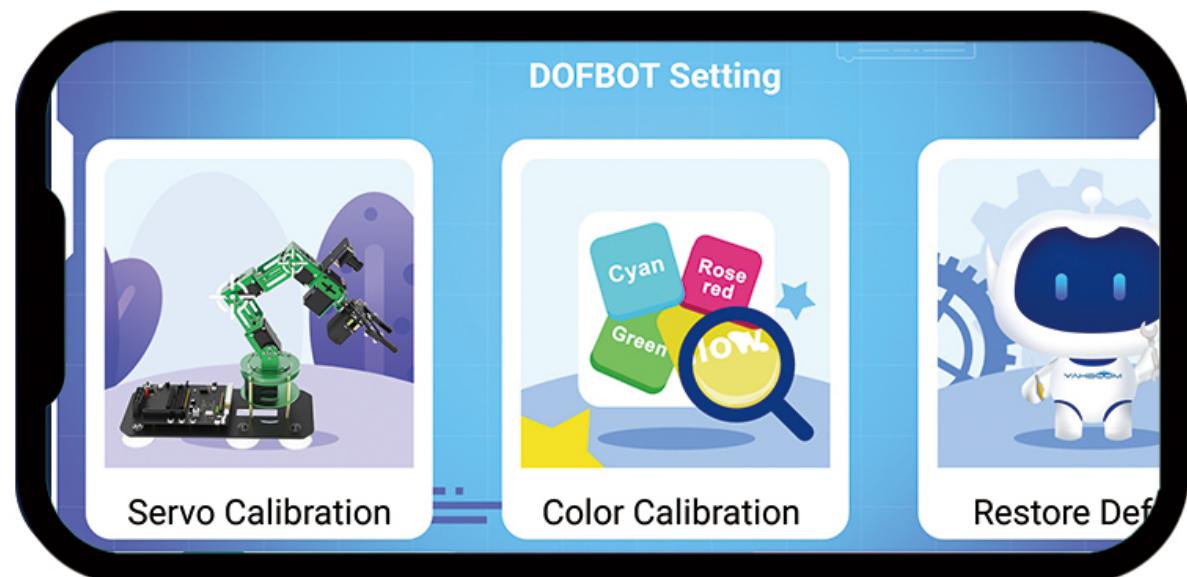
[Color sorting]: Click [1],[2],[3], [4] to change the color (black is not selected).Place different color blocks in the area recognized by the camera, wait for the color to be recognized. Click [Switch] to enable this function.

[Garbage Sorting]: Click the [Garbage Sorting], wait patiently for the model to load, and then place the block with the garbage picture in the area recognized by the camera. The system will automatically recognize the currently garbage. Click [Switch] to enable this function.

8. DOFBOT Setting

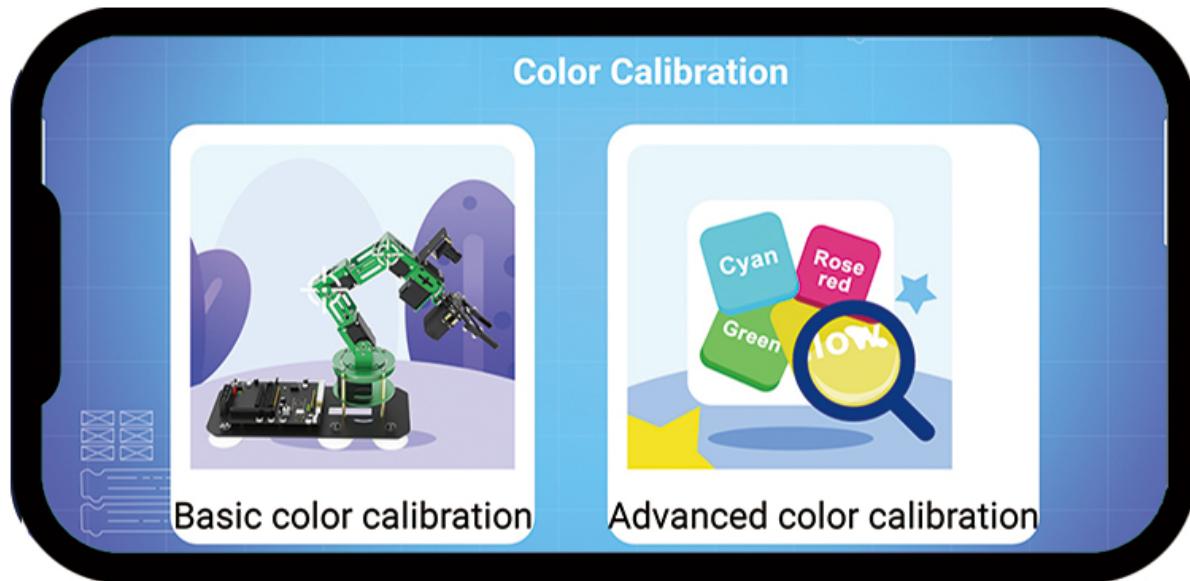


Click the [DOFBOT Setting] icon, the following interface will appear on APP.



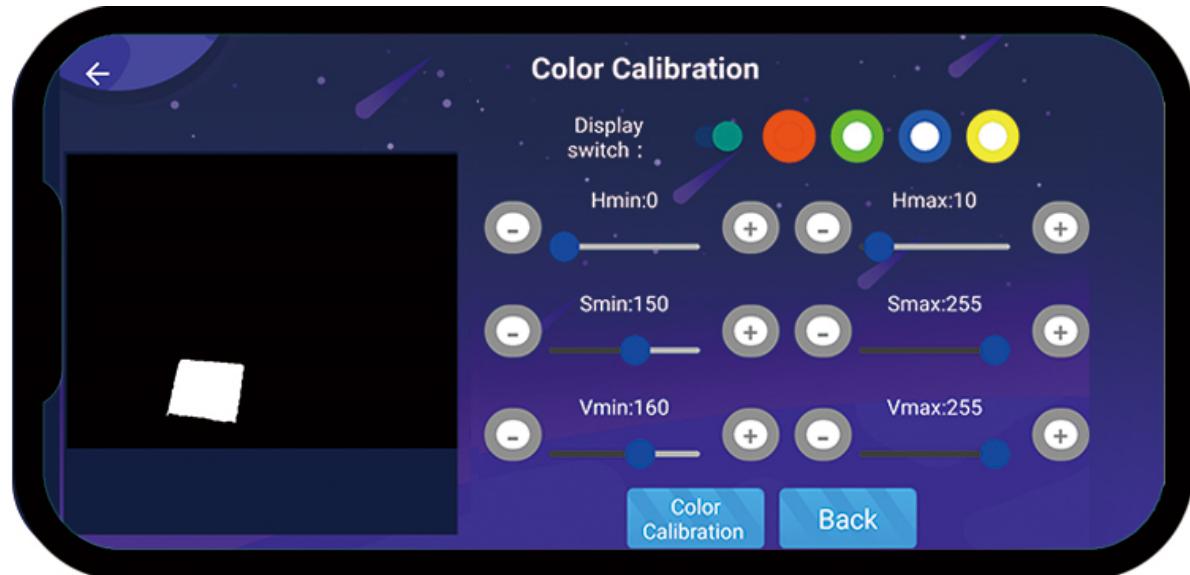
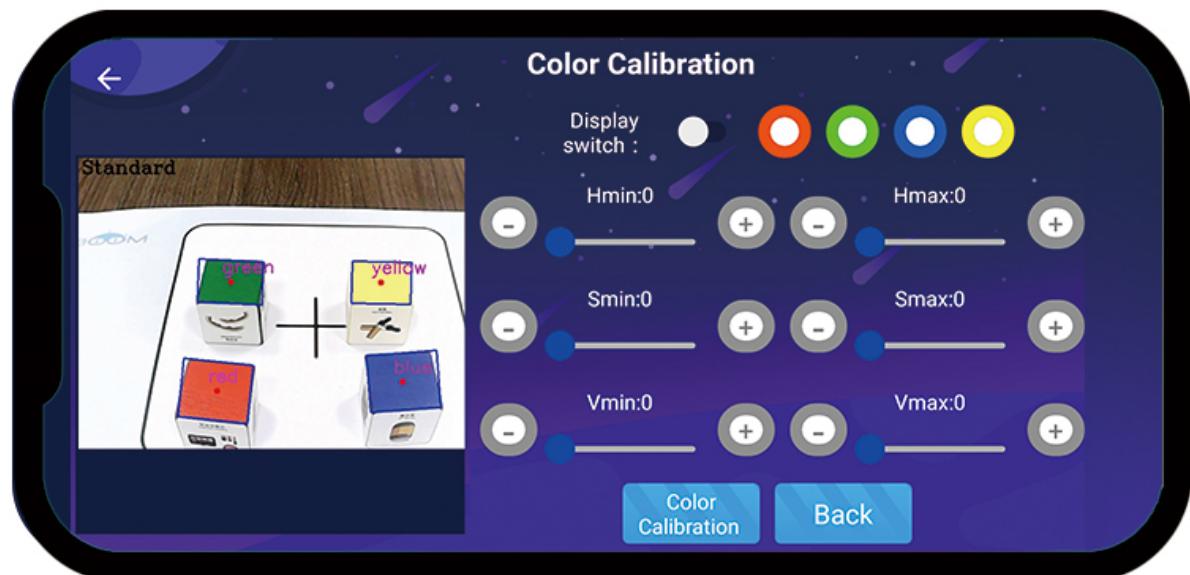
DOFBOT setting includes servo calibration, calibration, and restore the default.

[Servo Calibration]: The function is the same as that in the [Guide: Servo calibration].



Color calibration includes basic color calibration and advanced color calibration.

[Basic color calibration]: The function is the same as that in the [Guide: Color calibration].



[Advanced color calibration]:Place four color blocks in the field of view at the same time, select the color that needs to be calibrated.

Then, click the [Display switch] button to view the black and white image, and adjust through the HSV slider until it is not detected others colors.

Next, click [Color Calibration] to complete the calibration of this color, and calibrate other colors in the same way. Finally, click [Finish] to end this step.

For details, please see the course AI Vision Course--Color Calibration].

[Restore default]: Clear the configuration information of the APP.