Vision Kit Setup Tutorial

Vision Kit Specification

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Revision history

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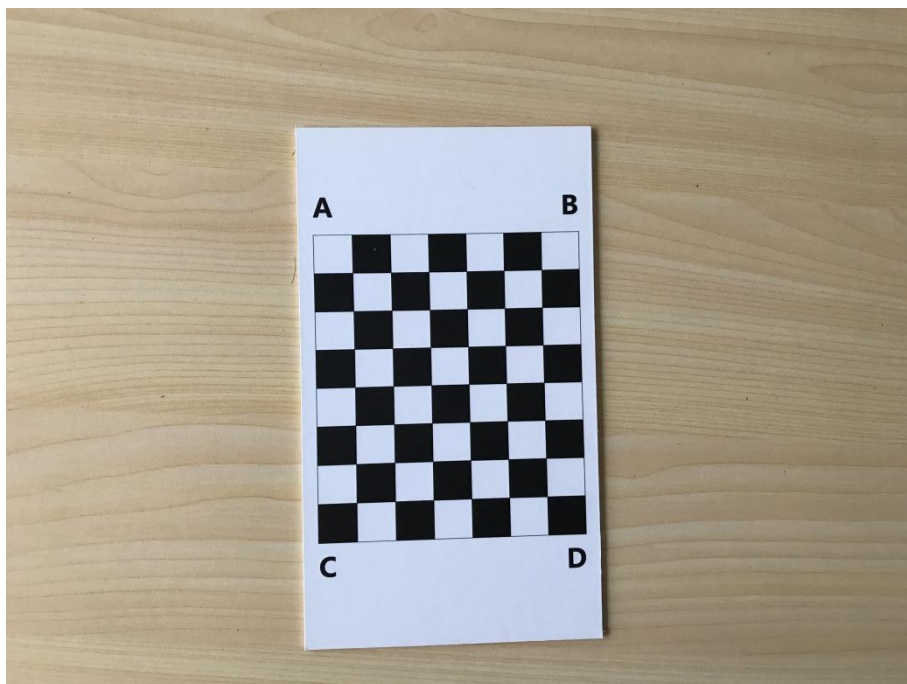7 Calibration board (as shown in Figure 1-8)

Figure 1-8

8 Tool kit（as shown in Figure 1-9）

Figure 1-9

1.2Camera parameters

HD color industrial camera	
Product No.	JHSM300f
Sensor size	1/2'CMOS
Sensor model	MT9T001
Effective pixels	3,000,000
Color	Color
Pixel size	3.2x3.2um
Frame rate/resolution	12 @2048 ×1536
Filter	650nm
Signal to noise ratio	42dB
Dynamic range	61dB
Shutter type	Rolling shutter
Exposure time	50.8um – 3329ms
Exposure control	Automatic/manual
Shell dimension	40x45x45mm
Data interface	USB2.0
Operating temperature	0 - 70℃
Lens mount	Mount C

1.3Light source parameters

White auxiliary light source	
Product No.	JHZM-A40-W
Light color	White
LED quantity	48 light emitting diode
Illuminance	40,000 lux
Brightness	Continuously variable, with adjustment range from 0 to 100% and constant color temperature
Wave length	455 – 457.5 nm
Output voltage	12 V
Output power	3.5 – 5 W
Working distance	35 – 110mm
Dimensions/specifications	Inner diameter: 40mm, outer diameter: 70mm, height: 25mm
Ring diameter inside	Max Φ 39mm
Weight	0.48 Kg
Working environment	Temperature: 0-40℃, humidity: 20-85%RH
Storage environment	Temperature: -20-40℃, humidity: 20-85%RH

1.4 Camera lens parameters

Megapixel prime lens of 16mm						
Model: M1614-MP2						
Focal distance			16mm			
Maximum of lens diameter to focal length ratio			1:1.4			
Maximum picture size			8.8mm×6.6mm (φ11mm)			
Working range	Aperture		F1.4-F16C			
	Focus		0.3m-Inf			
Control	Aperture		Manual			
	Focus		Manual			
Object dimensions			16.5(H)cm×12.4(V)cm 2/3"			
Visual angle	D	2/3"	38.0°	1/2"	28.2°	
	H		30.8°		22.7°	
	V		23.4°		17.1°	
Operating temperature			-20℃-+50℃			

Resolution	Above 100 line pair/mm on center and edge			
Deformation rate	2/3"	-0.1% (y=5.5)	1/2"	-0.3% (y=4.0)
Back focal distance	13.1mm			
Flange back length	17.526mm			
Mount	Mount C			

Filter dimensions	M30.5 P+0.5mm	
Dimensions	φ33.5mm×28.2mm	
Weight	65g	
Working distance (mm)	Optical magnification	Extension ring (mm)
300	0.05 X	None
250	0.06 X	0.5
200	0.08 X	0.5
150	0.10 X	1.0
100	0.15 X	1.5

2. Camera Installation

1 Fix the camera flange bearing at the bottom of the extension rod by screws, and connect the two extension rods, as shown in Figure 2-1 and 2-2.

Figure 2-1

Figure 2-2

2 Fix the camera flange bearing with at the camera plate by 4 M5*12 hexagonal screws, as shown in Figure 2-3.

Figure 2-3

3 Fix the industrial camera in the center of the fixture and adjust the spacing, as shown in Figure 2-4.

Figure 2-4

4 After assembling the camera support, fit it on the connecting rod and adjust the fixture on the camera support so that the camera support is fixed (about 50cm from the base plate), as shown in figure 2-5.
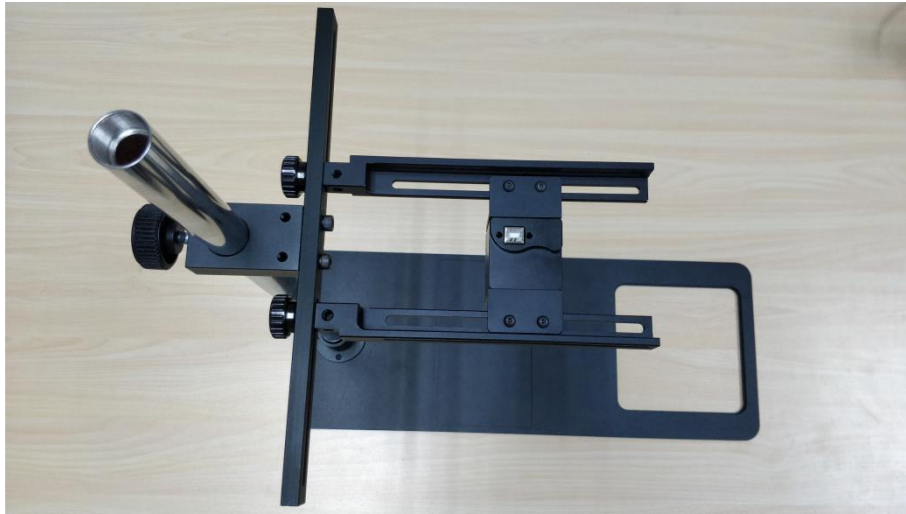
Figure 2-5

Figure 2-6

5 Pass the light source through the industrial camera, tighten three fixing knobs on the light source kit to lock it on the camera, connect the power supply, as shown in Figure 2-7, 2-8 and 2-9.
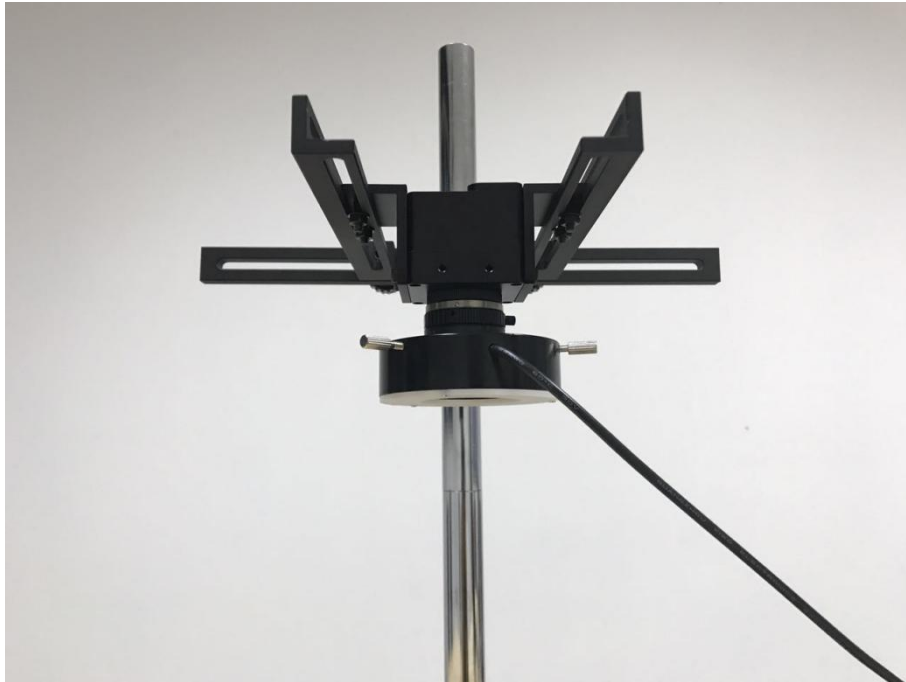
Figure 2-7

Figure 2-8

Figure 2-9

3. Robotic Arm Installation

The Dobot arm place on the floor, adjust the camera bracket, ensure the camera can be observed in the basic mechanical arm motion range. Connect the power and plug in the USB with the computer, the visual package is completed, as shown in figure 3-1.

Figure 3-1

4. Camera Calibration

1 Connect camera to computer by USB cable, open the **usbVideo.exe** software, click "Start" button to regulate focal length of the camera manually (note: Take off the light source before regulating the focal length, and put it back after the regulation process.), regulate the camera view to the best condition, and close the usbVideo.exe software. Steps are shown in Figure 4-1, 4-2 and 4-3.
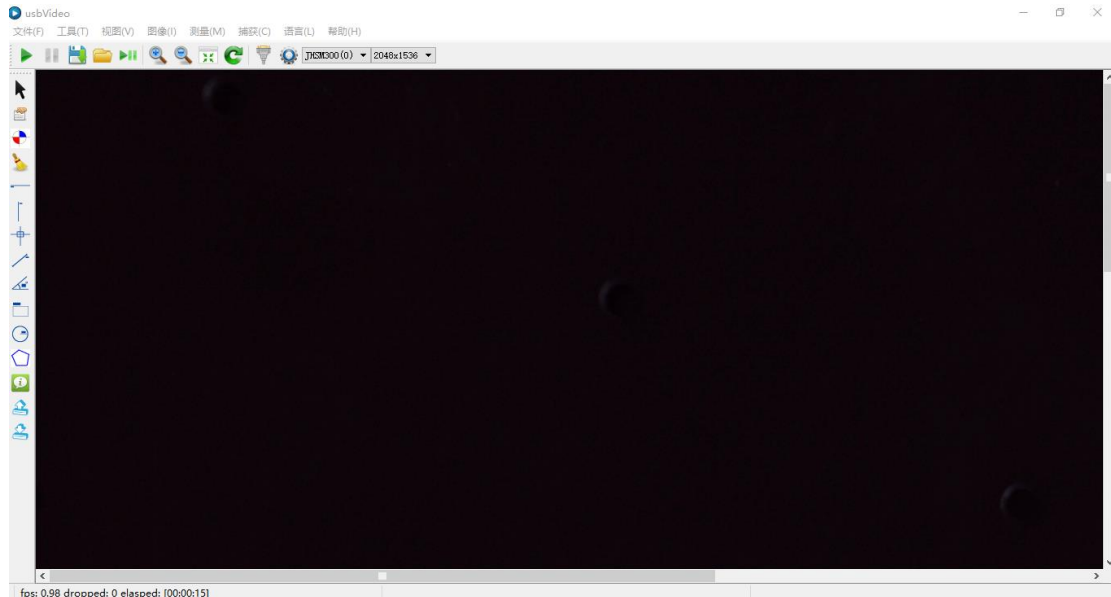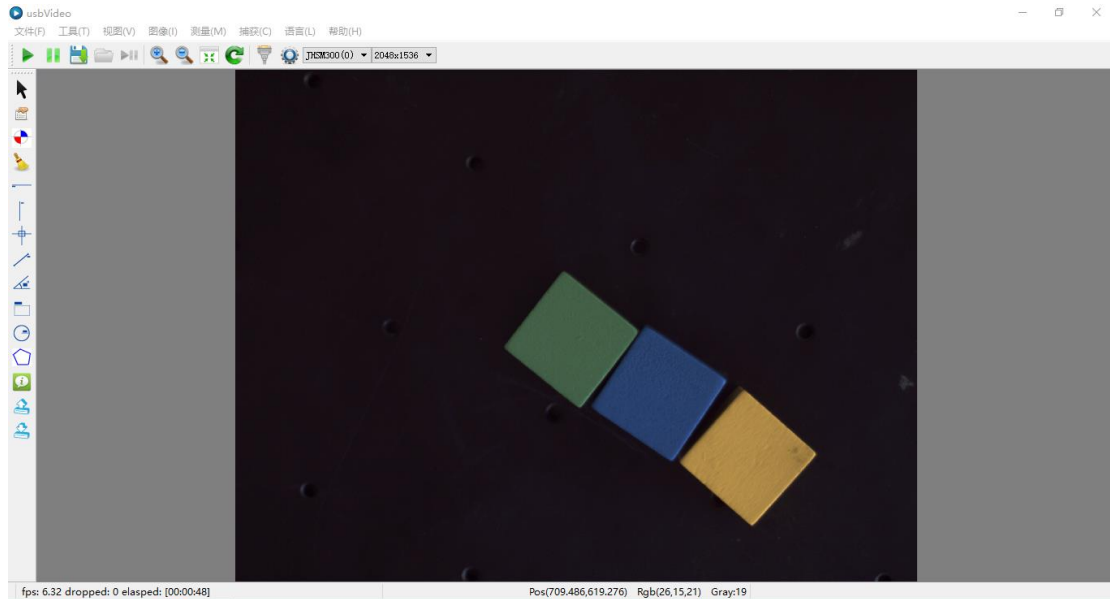

Figure 4-1

Figure 4-2

Figure 4-3

2 Power on Dobot Magician, connect the robot arm to the computer by USB cable, open VisionDemo.exe software, and click **"Click here to check the camera whether has been opened!"** button, open the light source light and regulate it to the suitable luminance until the clear image is shown, as shown in Figure 4-4.
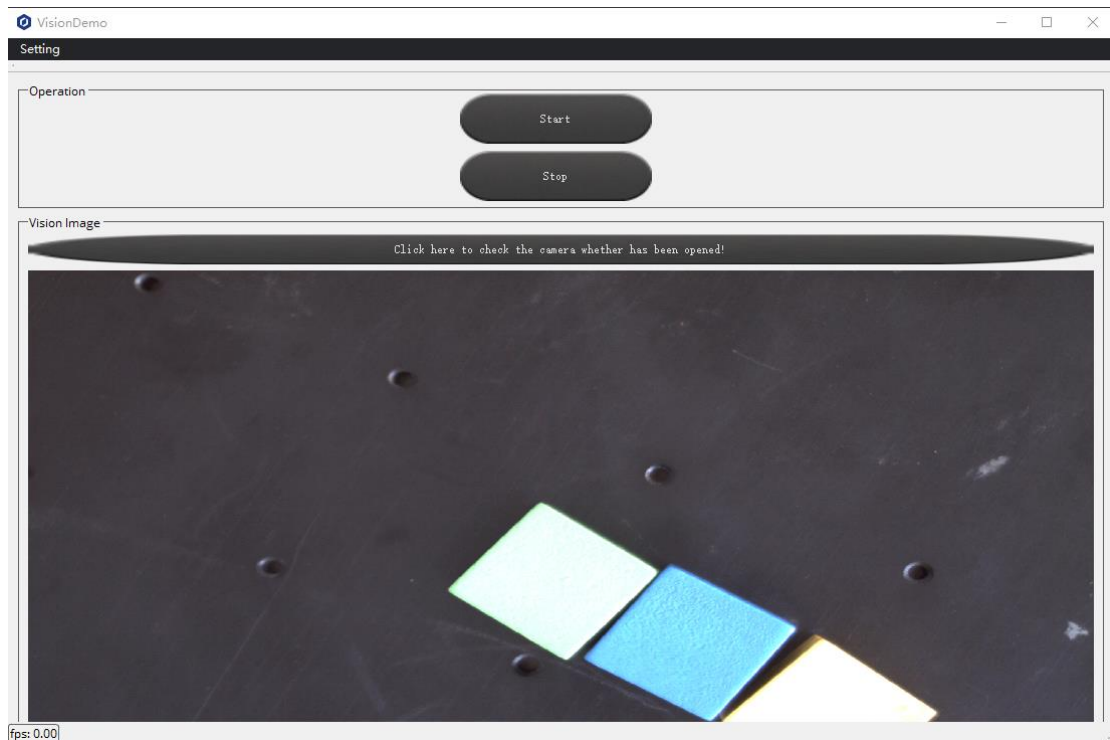

Figure 4-4

3 将标定板置于摄像头底板上，打开 VisionDemo.exe，点击 setting，选择 Matrix Calculate 功能，点击 GetImage,标定板上出现红绿蓝三点，此时软件会自动记录这三点在相机下的坐标参数（注意：如果相机未识别出标定点，调节光源亮暗，直到相机能识别标定板为止），如图 4-5 所示。
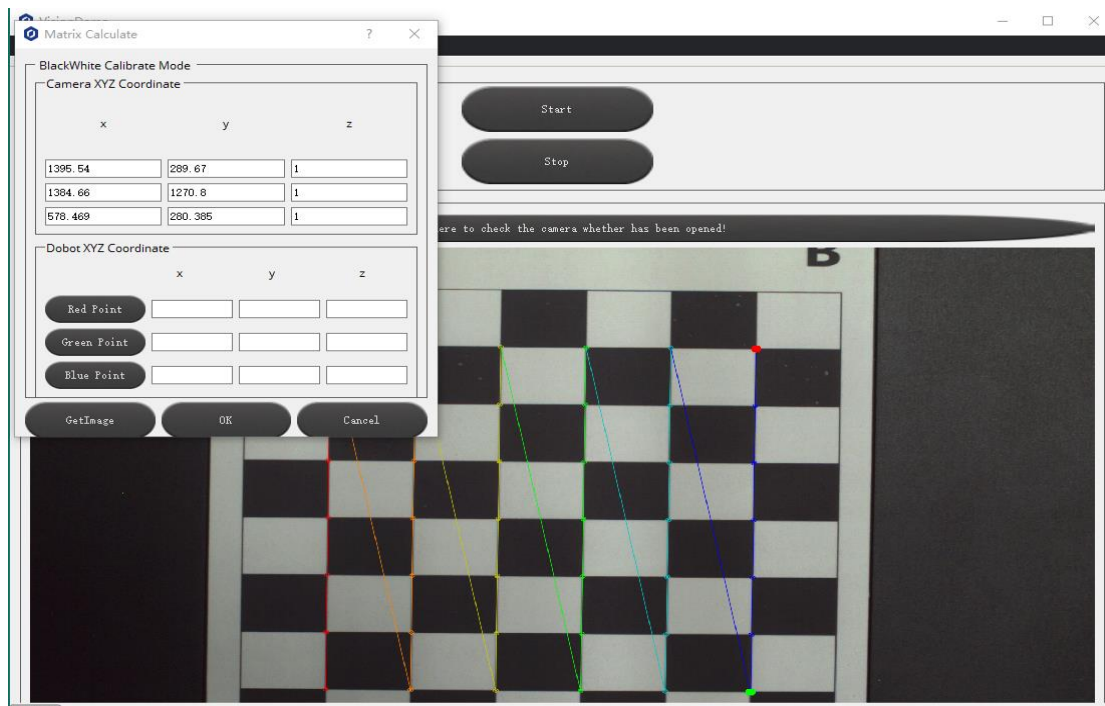

Figure 4-5

4 Use **Penholder** kit as the end tool of the robot arm, and according to the sequence of red, green and blue, respectively move the pen tip at the end of robotic arm to the three points (manually drag the robotic arm to the corresponding point, use the software inching **Dobot Jog** function to operate fine adjustment. At this time, the **Matrix Calculate** can be closed, and then it can be opened after the fine adjustment, as shown in Figure 4-6). Respectively click three buttons, namely **Red Point**, **Green Point**, **Blue Point,** when the pen tip reaching one point to record the coordinate of the three points respectively, click **ok** button to finish the calibration, and exit the **Matrix Calculate**. (Note: the sequence of the three points shall be calibrated in turn, red→green→blue, as shown in the Figure, and the order shall not be incorrect), as shown in Figure 4-7.
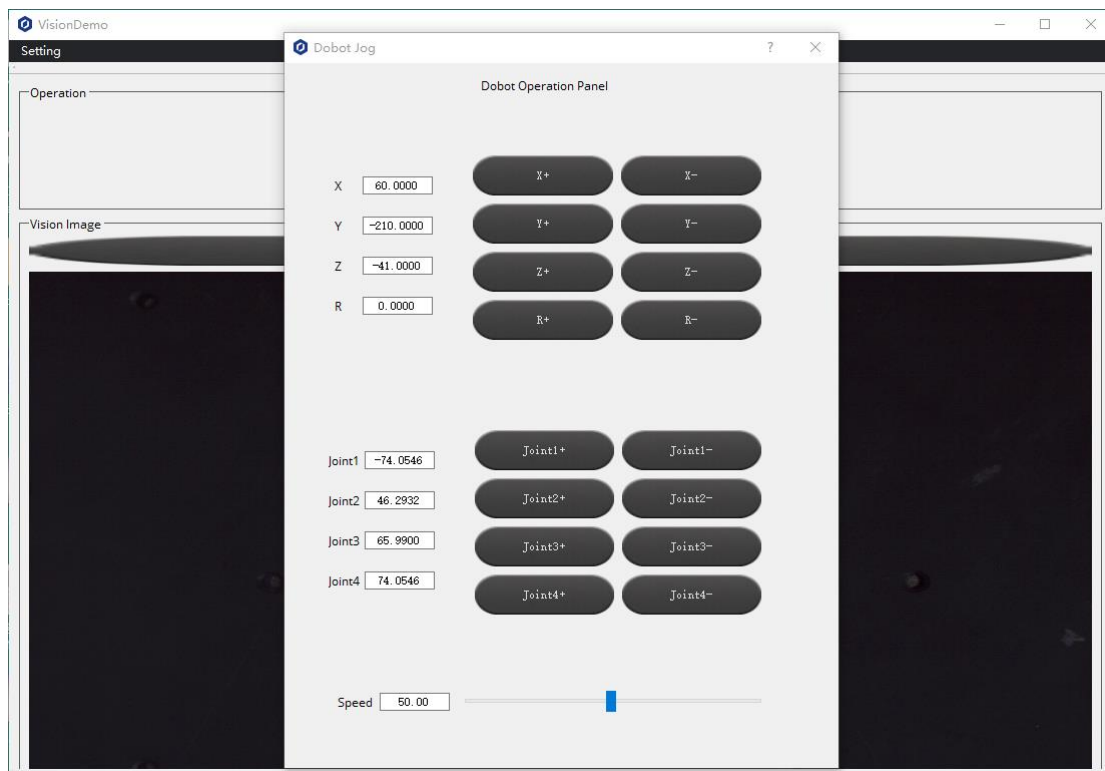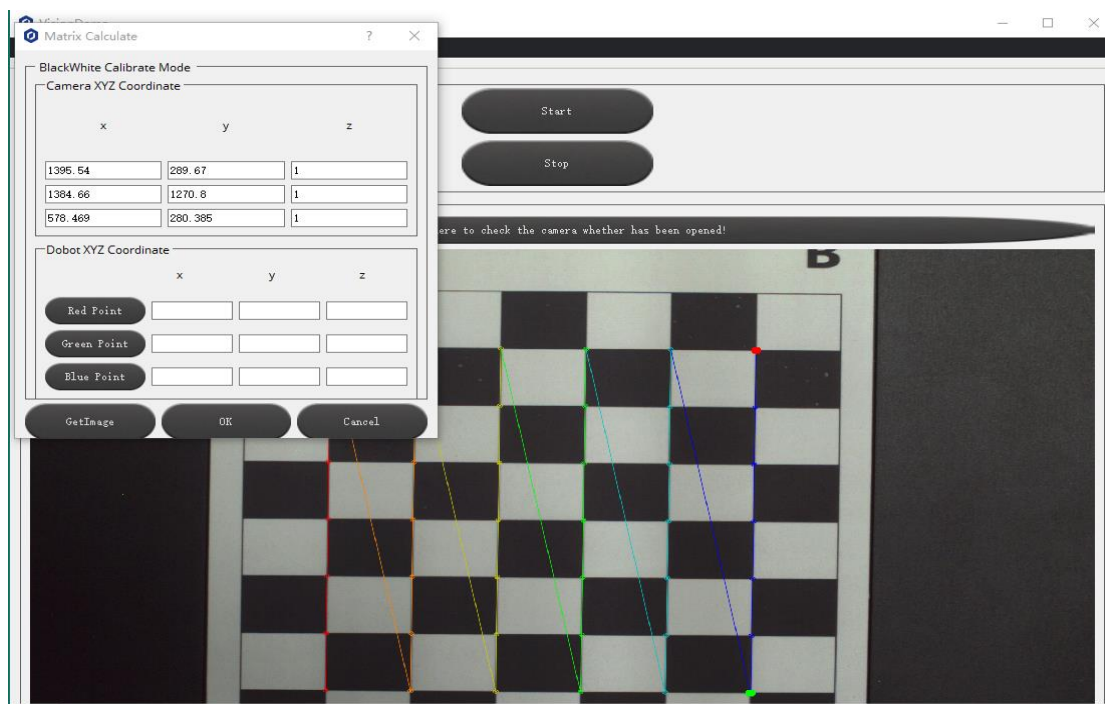
Figure 4-6

Figure 4-7

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5. Parameters Adjustment

5.1HSV(Hue Saturation Value) debug adjustment

Open the HSV Debug, wherein, H, S and V refer to hue, saturation value, and lightness; the value **lowH** and **highH**, **lowS** and **highS**, and **lowV** and **highV** are the hue range, storability range and lightness range between the two values. **minArea** and **maxArea** are the pixel area for filtering the influence of small objects. Click **GetImage** to activate adjustment bar. Firstly, select a color (*note: remember the object position on the display window of the target object to be adjusted after acquiring the iamge , such as green shown in Figure 5-1*), then adjust the HSG parameters range of target object, until the target object is completely displayed on the acquired image while objects of other colors completely disappeare. In Figure 5-2 an example of HSV adjustment for green color is demonstrated. Fellow the same steps to set parameters for other colors. 5-3 for yellow objects minArea and maxArea regulation, in turn check other colors, adjust and debug.
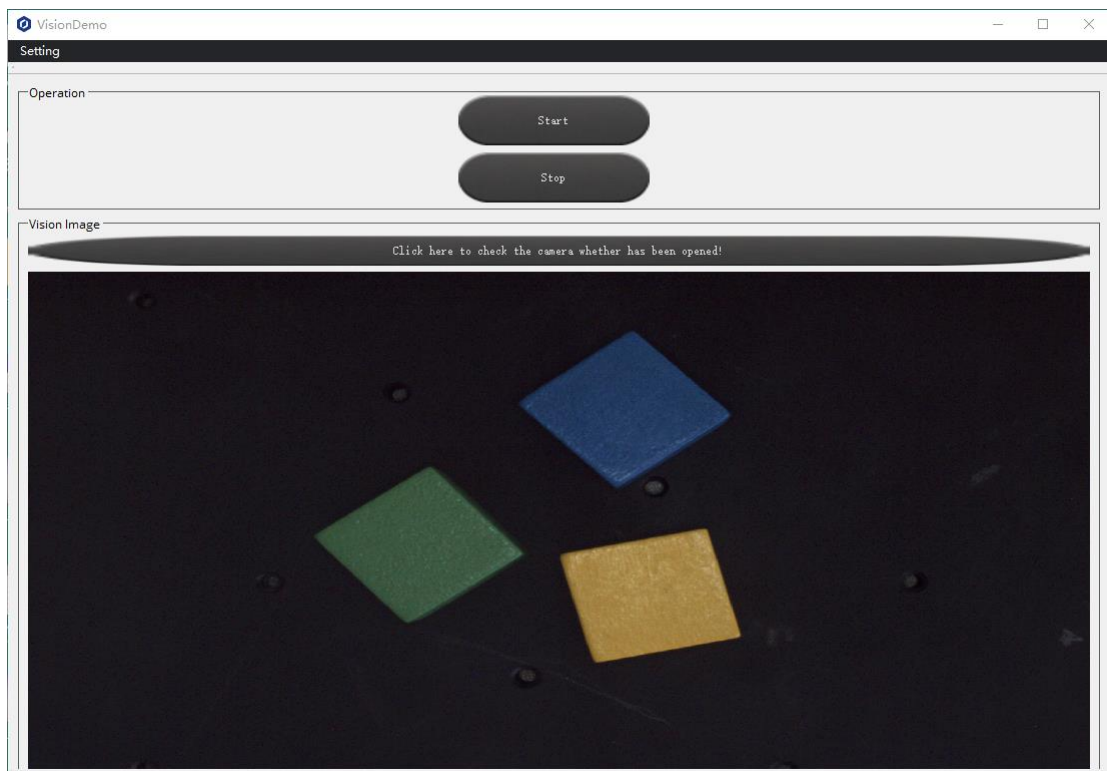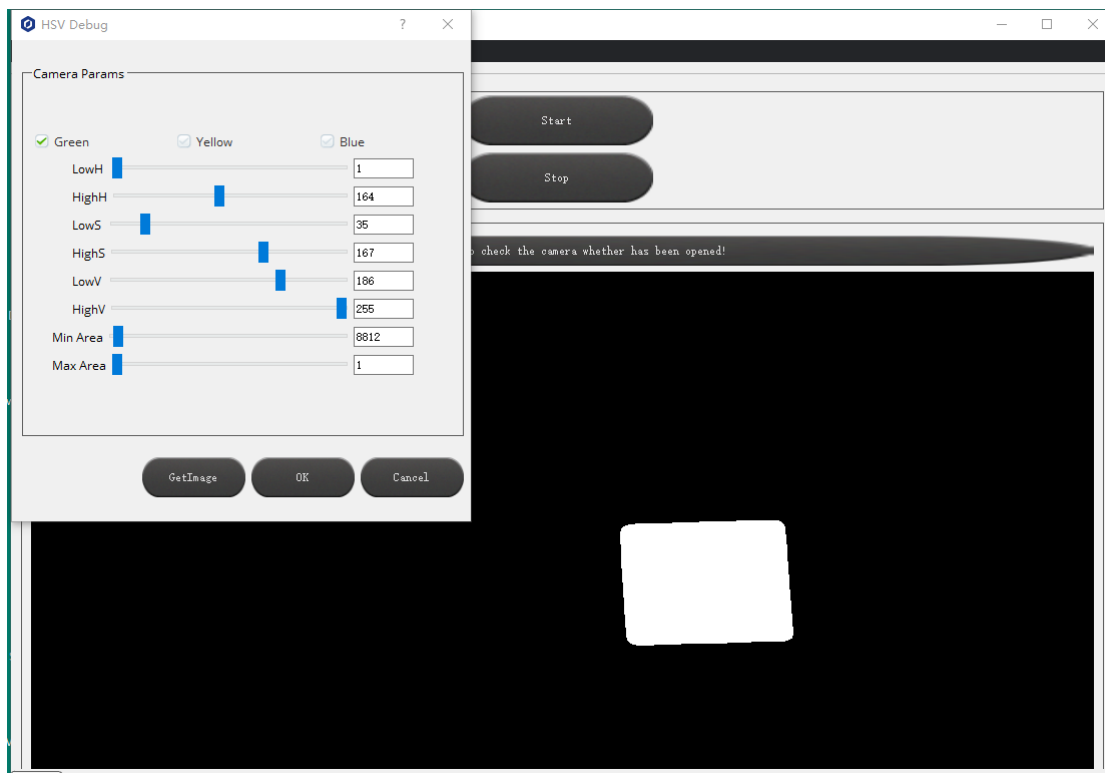

Figure 5-1

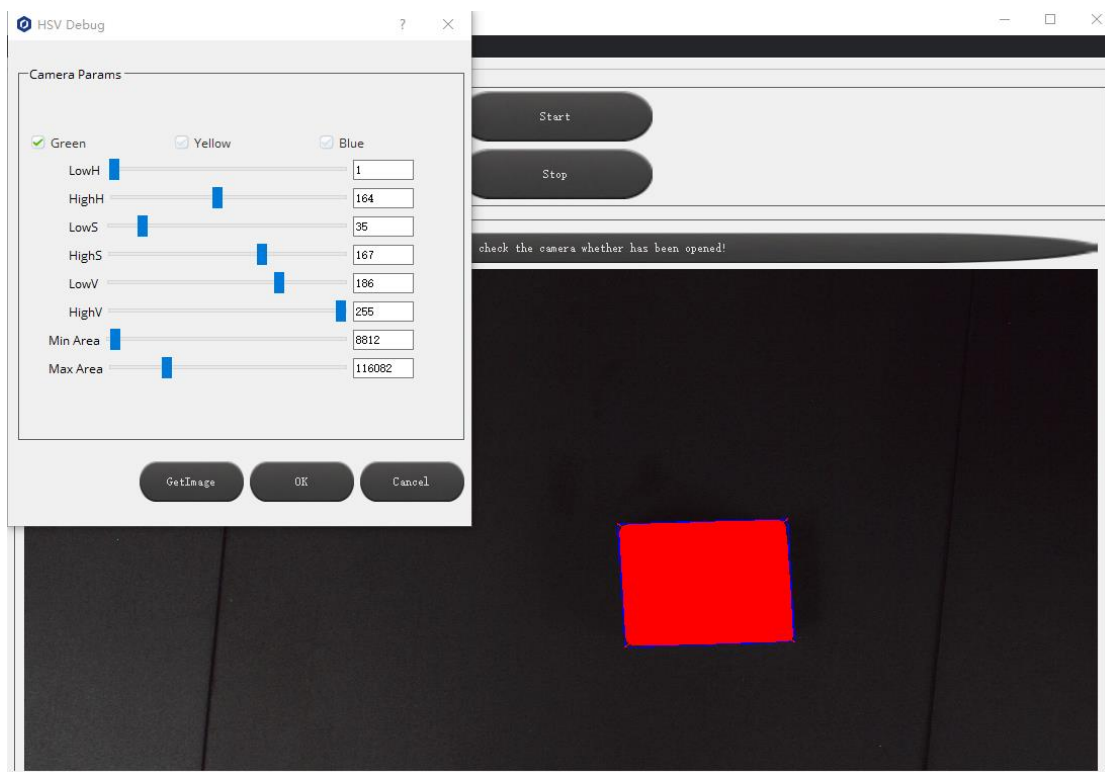Shenzhen Yuejiang Technology Co., Ltd.

Figure 5-2

Figure 5-3

5.2DobotParams adjustment

After HSV adjustment, open **DobotParams**, set the coordinate of setting place of the categorized objects, click **ok**, finish the setting place setttings(Detaild information of setting the operating parameters please refer to the user manual of Dobot Magician), as shown in Figure 5-4.
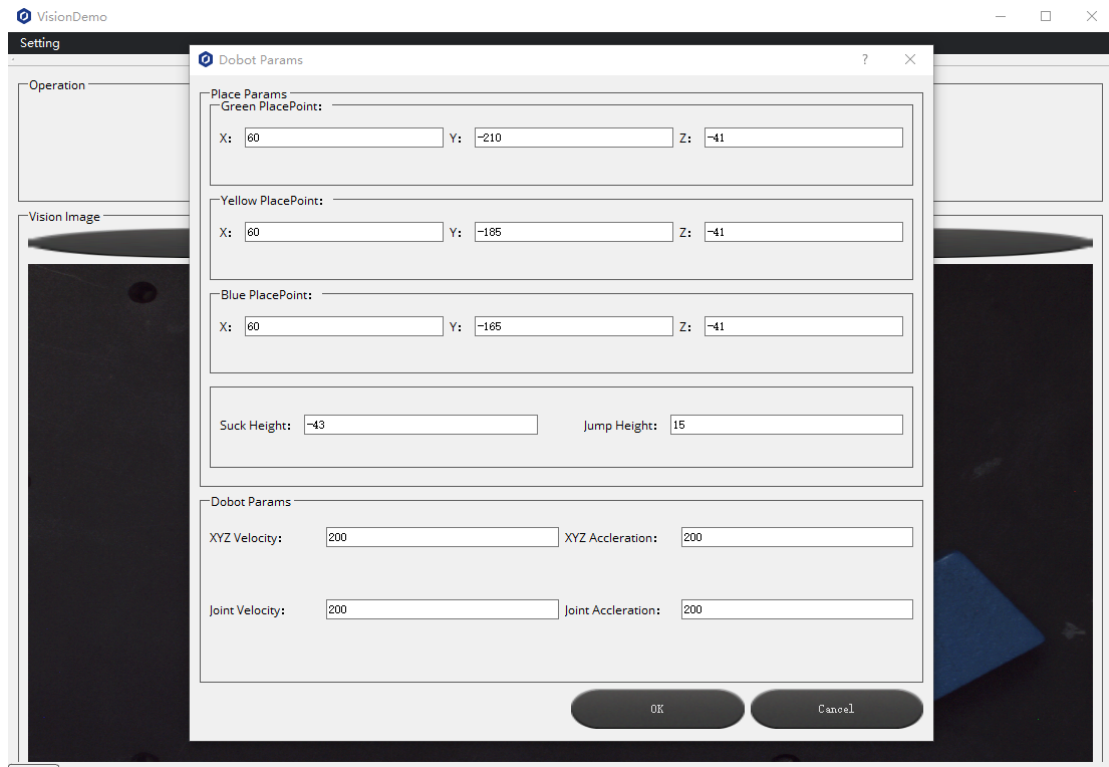

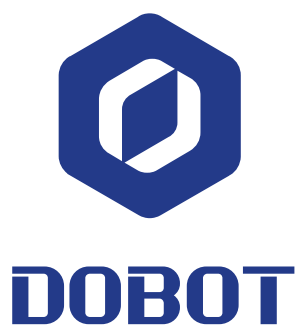
Figure 5-4

5.3 Machine Vison system operation

The robot vision system is ready to work after setting the parameters. Click **Start** button, and the robot arm will sort the object according to color, as shown in Figure 5-5, 5-6.

Figure 5-5

Figure 5-6

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