JAKA^尚节卡

Lens User Manual

JAKA Lens 2D



Version: V2.1

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CAUTION:

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JAKA will not provide after-sales service for any transformation or disassembly of the product.

JAKA reminds users that they must use safety equipment and comply safety protocols when using and maintaining JAKA robots.

Programmers and designers and debuggers of JAKA Lens 2D must be familiar with its programming and system application and installation.

How to Read This Manual

This manual mainly contains the usage of Lens 2D vision system, precautions for safe use of camera, installation and maintenance, etc. This manual will be a big help in both installation and operation to the users who have a basic level of mechanical and electrical training.

More Information

If you want to know more information about this product, please scan the QR code on the right to visit our website: www.jaka.com.



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Content

WHAT DO THE BOXES CONTAIN	6
CHAPTER 1 PREFACE	7
1.1 Preface	
1.2 Software Function	
1.3 Operating Environment	
CHAPTER 2 INSTALLATION CONFIGURATION OF SOFTWARE AND HARDWA	RE8
2.1 Preparation	
2.2 Camera Installation	
2.3 Settings of Camera Parameters	
2.3.1 Connection Check of the Camera	
2.3.2 Settings of Camera Functional Parameters	
2.3.3 Focal Length Adjustment of the Camera	
2.3.4 First Connection of the Webpage Interface	
CHAPTER 3 MAIN INTERFACE	
3.1 Main Interface	
3.2 Menu Bar	
3.3 Image Display Window	
3.4 Operation Button Bar	
3.5 Running Status Bar	
3.6 Running Result Bar	
3.7 Style Settings	
3.7.1 Logout	
3.7.2 Language Change	
3.7.3 Interface Style	
CHAPTER 4 PROJECT MANAGEMENT	20
4.1 Project	
4.1.1 Project Creating	
4.1.2 Project Editing	

JAKA。市卡

4 1 2 During 4 Stationer	21
4.1.3 Project Settings	
4.1.4 Project Deleting	
4.2 Project Tools	
4.2.1 Image Acquisition	
4.2.2 Template Matching	
4.2.3 Identification via Code Scanning	
4.2.4 Color Recognition	
4.2.5 Edge and Circle Identification	
4.2.6 Line Intersection	
4.2.7 Distance Calculation	
4.2.8 Character Identification	
4.2.9 Blob Extraction	
4.2.10 2.5D Space Ranging	
4.3 Project Saving	
CHAPTER 5 CAMERA MANAGEMENT	
CHAPTER 6 VISUAL CALIBRATION	
6.1 Visual Calibration Management Interface	
6.1.1 New Calibration	
6.1.2 Calibration Result	
CHAPTER 7 COMMUNICATION SETTINGS	41
7.1 Communication File Adding	
7.2 Communication File Editing	
CHAPTER 8 SYSTEM SETTINGS	43
8.1 Software Version	
8.2 Image File	
8.3 Log files	
CHAPTER 9 VISUAL APPLICATION CASE	45
9.1 Template Matching, Positioning, and Capturing	

JAKA。 节卡

9.2 Template Matching + Edge and Circle Identification	50
9.3 Color Recognition + Position Capture	54
9.4 Identification via Positioning and Code Scanning	59
9.5 Composite Robot Positioning Grabbing	62

What Do the Boxes Contain

Item	Amount
Lens 2D Camera	1
Compound Line	1
Visual Calibration Board	1
POE Switch	1
Camera Mounting Flange	1
User Manual	1
Accessories Bag	1

Chapter 1 Preface

1.1 Preface

JAKA Lens 2D is a visual operation software with the B/S structure. The software algorithm layer is separated from the interface layer. The algorithm layer runs under the Linux system and can be embedded in the electric control cabinet of the JAKA robot. The interface layer is in the Web page form and allows cross-platform access, so that users under Linux, Windows, Android, and any other platform can access the services of the algorithm layer, and can customize the functions to add, delete, or update items through the operation interface. They can also access the camera connected, change some of its parameters, and customize the algorithm of the visual items and the parameters of each visual tool. The process-based operation interface enables users to easily complete the configuration of visual scenes within 4-5 steps.

1.2 Software Function

1) Users can customize visual items;

2) Users can customize the configuration of the Socket communication interface and communication orders with the robot;

3) Users can customize the calibration file according to their visual scenes;

4) Users can set different operating parameters according to their project needs;

5) Users can customize camera parameters;

1.3 Operating Environment

Operating system	Linux_x64
System memory	More than 2G
CPU	Intel 64 or AMD 64

Chapter 2 Installation Configuration of Software and Hardware

2.1 Preparation

- ① A laptop equipped with a system above Win7 and a Google browser;
- 2 Contact JAKA's technicians for the camera configuration software, MGS_DRIVERS; or download it from JAKA's official website;
- 3 A set of robot and electric control cabinet
- ④ A gigabit switch/router (Note: A gigabit network port is required)

2.2 Camera Installation

After the camera is assembled, fix it at the end of the robot in a way as compliant as possible with the installation requirements in Figure 2.2.1 and 2.2.2, i.e. ensure that the camera is at the Y-axis direction of the terminal flange of the robot. If the installation cannot be completed under this condition due to working restrictions, in the subsequent hand-eye calibration, you may need to adopt manual calibration. You may try automatic hand-eye calibration first and choose manual calibration if the automatic one fails.

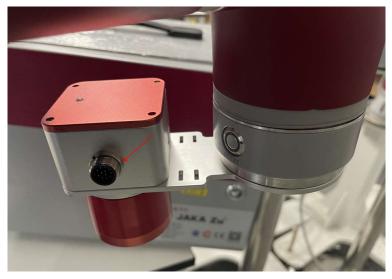


Figure 2.2.1



Figure 2.2.2

The camera cable is a composite cable (including network cables and power cords). Connect the network cable at the end of the composite cable to the gigabit router/switch in the same network as the robot. Connect the white power cord to the 24V power supply, and the black one to the 0V power supply.

As shown in Figure 2.2.3, when the power supply of the camera is connected normally, the indicator light will be green.



Figure 2.2.3

2.3 Settings of Camera Parameters

2.3.1 Connection Check of the Camera

After the camera software (MGS_DRIVERS) is installed on the laptop, there will be two software icons:



The GigeCameraConfig x64 is used to check if the camera is connected and change the IP address of the camera, while BasedCam2 x64 is used to test the functions of the camera.

Start the GigeCameraConfig software. As shown in Figure 2.3.1, check if the camera is connected normally and change its IP address.

\$ 192.	PCIe GBE Family Controller IP: 1 168.2.98 (GP502000247, Read Virtual Ethernet Adapter for VM	y)	Language	English		
	Virtual Ethernet Adapter for VM		IP Configuratio	n DHCP/LL Persister		
The came	a was found and succes	sfully connected	IP Address		×:	×:
			Subnet Mask		×:	×:
	en en la la composition de la compositi		Gateway	×:		10
mod	ify IP Address of camera	a/Realtek PCle 🔫		Reboot	B	Save
			User Defined			
IP Address	192.168.2.168		User Defined			
	192.168.2.168 255.255.255.0		User Defined	tion		10
Subnet Mask			-		Aut	BW
Subnet Mask Gateway	255.255.255.0		-	tion Auto IP	Aut	to BW
Subnet Mask Gateway Mac Address	255.255.255.0 192.168.2.254 18-31-BF-DF-D2-0E		-		Aut	to BW
Subnet Mask Gateway Mac Address Current speed	255.255.255.0 192.168.2.254 18-31-BF-DF-D2-0E		-		Aut	to BW
IP Address Subnet Mask Gateway Mac Address Current speed Packet Speed	255.255.255.0 192.168.2.254 18-31-BF-DF-D2-0E 1000 M		-		Aut	to BW
Subnet Mask Gateway Mac Address Current speed Packet	255.255.255.0 192.168.2.254 18-31-BF-DF-D2-0E 1000 M 9KB MTU		-		Aut	to BW

Figure 2.3.1

If the camera cannot be found in the above interface, try the following steps to solve it:

I Check if the laptop that installs the software is in the same local area network as the camera;

II Check if the router/switch accessed by the camera is a gigabit network port;

III Modify the jumbo frames of the laptop, as shown in Figure 2.3.2 and Figure 2.3.3;

IV Disable the firewall of the laptop.



🔋 以太网 Properties	×	Realtek PCIe GBE F	amily Controller Pro	perties	×
Networking Sharing		Details	Events	Power M	anagement
Connect using:		General	Advanced	About	Driver
Realtek PCIe GBE Family Controller Configure	-		erties are available for ou want to change on		
This connection uses the following items:	-	Property:		Value:	
	*	CCP 硬件件校验 研工CP 硬件件校验和 UDP 硬硬件校验和 UDP 硬硬整 优先送现和VLAN 传送规网传送感觉 大里传达感动 安收端调整 接收端调整最大	1 (IPv6) 1 (IPv4) 1 (IPv6) 2 (IPv4) 2 (IPv6)	9KB MTU	~
Install Uninstall Properties		接收缓冲区	~		
Allows your computer to access resources on a Microsoft network.					
OK Cancel	ł			ОК	Cancel

Figure 2.3.2

Figure 2.3.3

2.3.2 Settings of Camera Functional Parameters

Start the BaseCam2 software, as shown in Figure 1.3.4.

Step 1: Check if there is a camera in the camera list on the left. If not, it means that the IP address of the camera is not in the same network segment as the IP address of the laptop, or that the camera fails to power on. Follow the steps in Section 2.3.1 again;

Step 2: Connect the camera. Successful connection is shown in Figure 2.3.5;

Step 3: Set the camera exposure parameter and image format, as shown in Figure 2.3.6 and Figure 2.3.7;

Step 4: Turn the camera light source on or off, as shown in Figure 2.3.8;

Step 5: Be sure to save the camera parameters, as shown in Figure 2.3.9. Otherwise, after the camera is disconnected, the parameters will be restored to default ones.





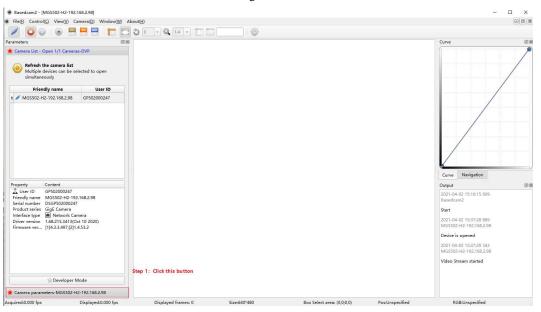


Figure 2.3.5



Camera List - Open 1/1 Cameras-DVP	🌟 Camera List - Open 1/1 Cameras-DVP
Camera parameters-MG\$502-H2-192.168.2.98	╈ Camera parameters-MGS502-H2-192.168.2.98
🔆 Hardware 🗖 Image 🖉 Advanced 🙎 🕩	🛞 Hardware 🗖 Image 🗍 Advanced 🛃 🕯
🖗 Acquisition 🤤 Exposure (🕥 Color 🛛 🛠 🕩	Acquisition 💡 Exposure 🕥 Color 🔮 🕯
ROI:(0,0;2592,1944) POS:Upper left	AE ROI:(0,0;2592,1944)
Full	Full
ROI	ROI
Edit	Automatic exposure
Resolution mode	Target 80 ‡
normal	Mode Automatic exposure
Quick ROI	Exposure
full	0s 🜲 37ms 🌲 478us 🌲
Source format	
RAW8 -	Analog gain
Target format	1.731
MONO8	
Acquisition rate	
normal	• DC

Figure 2.3.6

3

Figure 2.3.7

Camera List - Open 1/1 Cameras-DVP Camera parameters-MGS502-H2-192.168.2.98	🚖 Camera List - Open 1/1 Cameras-DVP
	Camera parameters-MGS502-H2-192.168.2.98
Hardware Image Advanced	🕼 Hardware 🛄 Image 📄 Advanced 🔰
✓ Trigger enable	🐨 Trigger 🗢 Line 🕞 User Set
Trigger once	Default Selector
TriggerSource	
Software 👻	UserSet1
Trigger loop	Save 🔪 🥑 Load
1000000.0 us	
Trigger signal	
Rising edge trigger 🔹	
Trigger delay	
0.0 us	
Trigger filter	
1.0 us	
Frames Per Trigger	
1frame	
Strobe signal	
Disable 👻	

Figure 2.3.8



2.3.3 Focal Length Adjustment of the Camera



Figure 2.3.10



Figure 2.3.11

Before adjusting the focal length of the camera, you need to set up the photographing position of the robot to ensure that the height and the visual field have met the photographing conditions, and then follow the steps in the above Figure 2.3.10 and Figure 2.3.12.

2.3.4 First Connection of the Webpage Interface

Check the IP address of the robot on its App. Start the browser, enter the IP address of the robot and the port number 9002 in the URL bar, click Login to enter the main interface of Lens 2D, and the interface as shown in Figure 2.3.12 will pop up. Suggest to use Google Chrome to

open without trace mode.

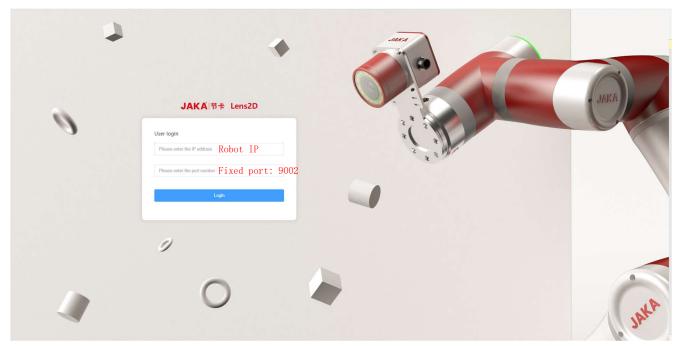


Figure 2.3.12 Interface of Successful Login

Chapter 3 Main Interface

3.1 Main Interface

The main interface is shown in Figure 3.1, consisting of the menu bar, display window, operation button bar, style settings, running log information, etc.

	Eens 2D			Operation button bar	JAKAİŦŧ
	A Home	Vision Image	Running project		Run
	Project	Original Image Result Image	fesk ×		
Menu bar	@, Camera		Running result Running status		
	Calibration		Selecting a project		Ý
	Connect Setting	John .			
Style settings		Jane A			
		Image display	Running 1	esult bar / Running status l	
				© 2022 JAKA, All rights reserved. 上南市卡机器,	《解被有限公司 20.1.1
Hide t	ie navig	ation bar Figure 3.1 Main	Interface		

3.2 Menu Bar

In the menu bar, users can choose to call up different functional interfaces, such as project management, camera management, visual calibration, communication settings, system settings and other sub-interfaces.

3.3 Image Display Window

During the project operation, users can check the effect of the image currently processed by the visual software in real time through the window.

3.4 Operation Button Bar

Drop down the box, and you can choose to run a project by clicking "Run". When running a project, you will find the button is changed to "Stop". Click it, and you can stop running the project.

3.5 Running Status Bar

The running status bar will print the logs of the visual algorithm layer in real time. Users can monitor the running status through these logs.



Running proj	ect	∜Stop
test2		~
Running result	Running status	
#	Log time	Log message
1	2022-11-04 07:03:39	Vision Projects Start Run

Figure 3.5 Operation Button Bar

3.6 Running Result Bar

The running result bar will print the coordinate information and text information such as templates, points, lines, and colors identified during the operation of the project in real time.

3.7 Style Settings

In style settings, users can change the display style and language of the interface. The option to log out is also here.

3.7.1 Logout

Click to log out of the system and return to the login interface.

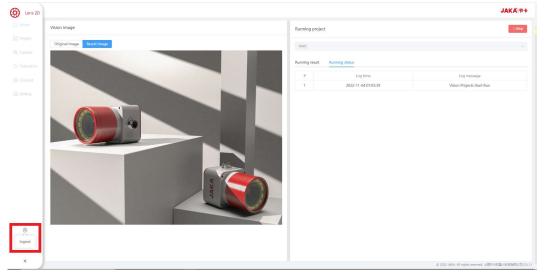


Figure 3.7.1 Operation Button Bar

3.7.2 Language Change

You can change the language of the interface as needed.



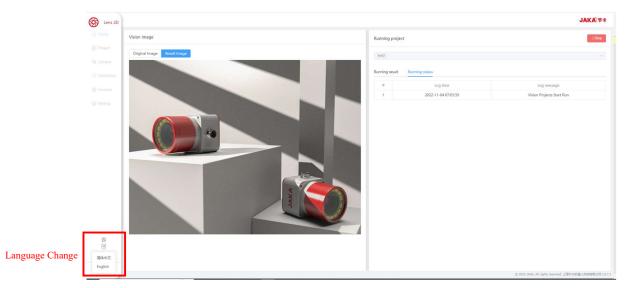


Figure 3.7.2 Language Change

3.7.3 Interface Style

You can adjust the style of the interface as needed. This includes the adjustment of interface size and display style.

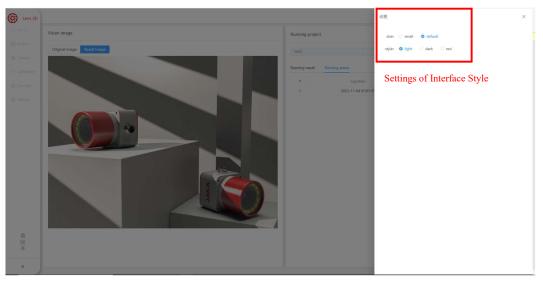


Figure 3.7.3 Settings of Interface Style

Chapter 4 Project Management

4.1 Project

In the project management interface, users can create new projects, edit projects, set projects, and delete projects.

After you finish editing a project, its general information will be displayed in the project list, including its name, communication type, visual calibration status, and date.

Lens 2D					JAKAI带卡
	项目管理				18:00
回 相机管理	项目名称	通讯	视的标志	日期	3局(1)=
○ 视觉标定	現6±001 777			2022-08-10 13:36:55 2022-08-10 16:18:54	2 © ©
③ 通讯设置	test			2022-08-11 09:46:40	2 © 🖻
示 系统设置	0811			2022-08-11 10:26:08	۵ 😢 🖻
	项目8-10			2022-08-11 12:00:10	2 ©
«	08-11 模板 08-11形状	\$3000	标定23	2022-08-11 15:49:25 2022-08-11 16:26:31	2 © 0
্র ঈ≰ ©					
8					

Figure 4.1 Project Management - Project List Interface

4.1.1 Project Creating

Click "Create" in the project management interface to show the interface to add a new project. It is required to name the new project here.

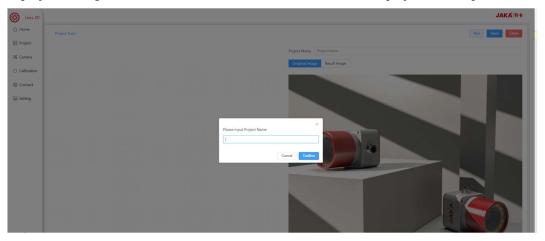


Figure 4.1.1 Interface to Add a New Project

4.1.2 Project Editing

Click "Edit" in the project management interface to show the interface to edit a project. It consists of project tool bar, project name, original image, processed image, flow chart display, and project operation control buttons. The interface will display the project information saved last time, and users can edit it as needed.

The project flow chart consists of several tool components and arrows. Choose tool components in the project tool bar, and after you complete the editing settings, drag them into the flow chart. The specific use of each tool will be introduced in the next section.

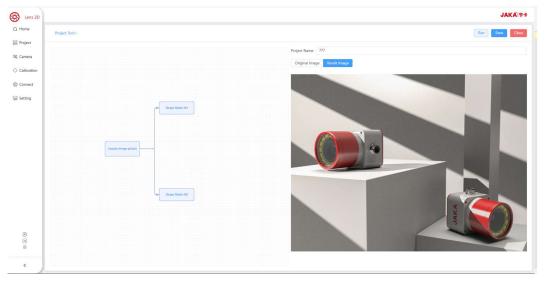


Figure 4.1.2 Interface to Project Editing

4.1.3 Project Settings

In the project management interface, select the item you need to set from the project list, and click the icon 🕸 to enter the interface to set a project. In this interface, you can set the project calibration file, communication file, visual base point, and compensation coefficients;

Calibration file: a file generated by the visual calibration module;

Communication file: a file generated by the communication setting module;

Visual base point: a visual reference point for template capture;

How to set a visual base point:

- 1. Enter the interface to set a project, select the calibration file and save;
- 2. Enter the homepage and run the project;
- 3. Use the robot APP to send a capture command;
- 4. Check the results of the template matching tool in the result bar, and record X, Y, and Rz
- 5. Stop the project;
- 6. Open the project settings, fill in base point X, base point Y, and base point A with the recorded values;

7. Click "Enable Visual Base Points", save, and exit.

If an absolute target point is enabled, it is required to input the X, Y, Z, Rx, Ry, and Rz of the base position robot. Whether to choose absolute coordinates or relative coordinates, the visual equipment is always sending 6-digit coordinate data. When absolute coordinates are not enabled, template matching returns an offset; When absolute coordinates are enabled, coordinates are returned directly.

Project parameters setting		Sam Class	
Vision calibration Vision calibration			
Communication file Communication file			
Rectify the image			
Vision base setting Compensation fact	or setting		
Enable vision base			
Vision base	Base point value		
Base point X	- 0 +		
Base point Y	- 0 +		
Base point A	- 0 +		
Enable vision absolute coordinate			
Robot base	Base point value		
Base point X	- 0 +		
Base point Y	- 0 +		
Base point Z	- 0 +		
Base point RX	- 0 +		
Base point RY	- 0 +		
Base point RZ	- 0 +		

Figure 4.1.3 Interface to Project Settings

4.1.4 Project Deleting

To delete the project, select a project in the project list and click "Delete".

4.2 Project Tools

Project tools include image acquisition, template matching, code scanning, color recognition, edge and circle identification, line intersections, distance calculation, monocular measurement, and blob extraction, character identification, 2.5D space ranging. When using each project tool, it is required to name the tool first.

4.2.1 Image Acquisition

The image acquisition interface is divided into two parts according to the source of the image: from the camera and from files.

In the camera interface, users can choose a camera to use by camera names;

Tool Name: The name of a tool, available in Chinese, English, and digital mode;

Picture Format: You can select from color images or monochromatic images; Mono8 is monochromatic images, and RGB is color images;

Flashlight: It can be set to Off, On, or Allowed,

Exposure: Adjust the exposure time, within the range of (0, 100,000,000);

Magnification: Adjust the camera magnification, within the range of (0,15);

Click "Run" to get one image in the display window, as shown in Figure 4.2.1-1.



Acquire Image	×
*Canera Narre *Picture Format *Fash Lig *Epoce	File picture D0371HNK DSGP502010111 V Monod V ht On O Off Flash rei 40000 + + +
an a	Save

Figure 4.2.1-1 Image Acquisition-camera

In the file interface, select an existing picture in the "Select File" drop-down box. Click "Run" to get the image displayed in the window. Click "Save" to save the image into the project.

Acquire Image	×
Camera Tie * Tool Name perturbagert.bmp * Select File JJXVesion/Picatriputimagert.bmp	
prov next	Save

Figure 4.2.1-2 Image Acquisition-file

4.2.2 Template Matching

Template matching tools are mainly used for positioning. Take images of the item to be captured, select the main characteristics of it, and create templates.

When creating a template, select "Circle" or "Rectangular" tool above the image to create the selected area for the template, and select the "Capture Point" tool to put "Capture Point" on the template.

Matching Algorithm: "ShapeMatch_BaseShap" is a matching Algorithm based on shapes, "ShapeMatch_BaseGray" is based on gray scales, and "ShapeMatch BaseComponent" is based on components;

Matching Score: the similarity with the template, with a range of [0,1];

Number of Templates: the maximum number of templates in an image;

Min/Max Angle: this determines the range of possible rotation. Models may appear in the image after rotations within the range of [-360,360];

Min/Max Area: this determines the range of the possible size of a model. 1 stands for the original size of the corresponding model.

Click "Run" to get the processed image in which templates are marked, and the position information and result information of templates are shown on the right. Click "Save" to save the results into the project.

Shape Match						×
Original Image Result Image		Params Info	mation	Result		
The model Area is 25339.000		* Tool Name	M1			0
Height is 218.000 Width is	s 216, 000	Model Type	• Create	Model	C Load Model	
		Match Algorithm	ShapeMa	tch_BaseShi	ape	
	JAKA Lens 2D	* Min Score	-	0.5	+	
	JAMA LENS 20	* Min Result	-	2	+	
		Num				
		* Min Angle	-	0	+	
		* Max Angle	-	360	+	
1000		* Min Scale		0.98	+	
1000	JAKA Lens 2D	* Max Scale	-	1.02	+	
	\frown					
1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1						
)					
		Run				Save

Figure 4.2.2 Template Matching



4.2.3 Identification via Code Scanning

The code scanning function is mainly for bar codes and QR codes.

Users select the "Regional Search" icon in the image area, circle the area which includes the code, and then select the code category, code system, processing mode, polarity, number of identification objects and timeout. Click "Run", and the code scanning result is displayed in the image processing interface. Click "Save" to save the results into the project.

	* Tool Name IdS	Scan	
		Picture	
1 1 年 TD・ 19345	Code Type Co	ode2D	
	Symbol Type QR	RCode	
	Scan Type JKI	1DQuick	
	Code Polarity dar	rk	
	* Search Num -	1 +	
	* TimeOut -	1000 +	
	r		

Figure 4.2.3 Identification via Code Scanning

Code category: Bar codes (Code1D) and QR codes (Code2D);

Code system: This tool supports common code systems such as Aztec, DataMatrix, PDF417, and QR Code.

Processing mode: Three modes are available: Quick (JKIDQuick), Standard (JKIDStandard), and Max (JKIDMax);

Polarity: The polarity of bar codes in the environment, divided into dark or light;

Number of identification objects: The number of codes in an image. It is recommended to be less than 20;

Timeout: Set the time limit for identification, within the range of [0,5000] ms.

4.2.4 Color Recognition

Color recognition tools are used to identify items with obvious color characteristics. Before identifying, you need to train it (no more than 3 colors each time).

Click the "Circle" tool to select the color to be used in training from the image and name the color. Select the color used in training, select "Enable", click "Train" and wait for training and running (note that the color recognition function requires some training time). After running, you will find trained colors in the image. Click "Save" to save the results into the project.

If the color recognition tool is based on the template matching area, the search box should be inside the template. This can avoid misidentification due to the multiple templates that pile up. As shown in Figure 4.2.4.

Color Detect						×
Original Image Result Image	* Tool Name	color				
	Select Space	@ShapeMatchTool	⊷m			×
	Color	Please draw at mos	t three colors with c	ircle		
	ColorName	Center X	Center Y	Radius	Enable	Handle
	blue	143.65	112.36	27.89		•
	red	383.53	199.98	31.63		•
	yellow	147.95	296.22	30.74		i i i i i i i i i i i i i i i i i i i
	Run					Save

Figure 4.2.4 Color Recognition

4.2.5 Edge and Circle Identification

Edge and circle identification is used to find the coordinates of lines or circles in an image;

Edge identification: Select "Ruler" over the image on the left;

Circle identification: When using circle identification, select "Circular Ruler" over the image on the left.

Use the ruler to draw on edges or circles to be identified, set the edge contrast, point to be ignored, and edge polarity, and then click "Run". After the tool runs, you will see identified edges or circles in the image processing interface, and the starting point and end point coordinates or center and radius of the circle in position information. Click "Save" to save the results into the project.

Areas available: the area can be the entire picture or the template area. If the entire picture is selected, the position for identification will not be changed; if the template area is selected, the position for identification will change with the template position;

Identification type: edge or circle;

Ruler number: the number of rulers;

Ruler length: the length of rulers;

Ruler Width: the width of rulers;

Edge contrast: the contrast range between the edges and the surroundings pixels is [0,255]

Point to be ignored: the default value is 0;

Find Line or Circle

Polarity: from dark to bright, from bright to dark, or both of them.

Ciriginal Image Result Image	Params Information	
	* Tool Name line	
	Select Space Pind Type Circle ircle Circle Circle Circle Circle Circle Circle Circle	
	* Edge Polarity O Dark To Ught O Dark O All	ave

Figure 4.2.5 Edge Identification

Find Line or Circle		×
Original Image Result Image	Params Infomation	
	* Tool Name circle	
	Select Space @Picture	
	Find Type O Line O Circle	
	* Caliper Numb - 16 +	
	er	
	* Caliper Length – 100 +	
	* Caliper Width – 20 +	
	* Edge Contrast – 0 +	
	* Ignore Numb - 0 +	
	Edge Polarity O Dark To Light O Light To Dark O All	
	Run	ave

Figure 4.2.6 Circle Identification

4.2.6 Line Intersection

The line intersection tool is used to calculate the coordinates of the intersection point of the two straight lines.

In the line intersection tool editing interface, select "Line 1" and "Line 2" in the drop-down box, and click "Run". After the tool runs, the intersection is displayed in the image processing interface and the coordinate information is on the right. Click "Save" to save the results into the project.

Intersect Line to Line			×
Original Image Result Image	* Tool Name	point	
Intersection Point: (1463.674,768.722)	Line 1 Line 2 InterPoint	Inet Ine2 X: 1463.67 Y: 768.72	
	Run		Save

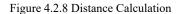
Figure 4.2.7 Line Intersection



4.2.7 Distance Calculation

The distance calculation tool is used to calculate the distance between two points or between a point and a line. After selecting the corresponding function, select one point or one line in the "Object 1" and "Object 2" drop-down boxes. Click "Run" to calculate the distance between the two objects, and the two objects and the distance value will be displayed in the figure.

Distance Calculate		×
Original Image Result Image	* Tool Name distance	
Distance: 330.813	O Point To Point O Point	io Line
	Object 1 point	
	Object 2 line3	
	Distance Result 330.81	
	Run	Save



4.2.8 Character Identification

The text recognition tool is used to recognize printed characters on an image.

The user selects the "Area Search" icon in the image area, circles the recognized area, and then sets the text box, skew correction, language type, score threshold, and text box spacing. Click "Run" to display the text recognition result in the processing image interface. Click "Save" to save the result to the project.

OCR		×
Original image Result Image	Params Result	
	* Tool Name 0	
	Select Space @ShapeMatchToolm	
	DetDbScoreMode 🔾 Yes 🔹 O No	
	Angle Detection 🔿 Yes O No	
	* Text Angle - 0 +	
	* Language Chinese	
OCR OCR	* DetDbBoxThresh - 0.5 +	
	* DetDbUnclipRatio - 1.5 +	
152		
	Run	Save

Figure 4.2.9 Character Identification

Optional space: the space range can be the whole picture (Picture) or template area, if you choose Picture, the text recognition search box position is fixed; if you choose template area, the text recognition search box position will change according to the change of template position.

Polygon text box: check "Yes" to use polygon box calculation, check "No" to use rectangle box calculation. Polygonal boxes are more accurate for curved text areas, but the recognition speed is reduced.

Automatic tilt correction: check "Yes" for automatic tilt correction (use it when recognizing lots of texts).

Manual correction: set the number of degrees of counterclockwise rotation of the image, in the range [-360, 360].

Language type: set the language type of the text to be recognized, supporting Chinese, English, Japanese and Latin.

Score threshold: set the score threshold for text detection, range [0,1]. It can be reduced appropriately when there is text leakage detection.

Text box spacing: set the distance between the text detection box and the text, range [1,2]. It can be reduced appropriately when the spacing between two rows of text is small leading to overlapping text boxes.

4.2.9 Blob Extraction

The blob extraction tool is used to detect and extract areas with higher or lower gray-scale value in an image.

The extraction mode includes three algorithms: hard threshold, dynamic threshold, and automatic threshold.

Hard threshold: input the target threshold range within [0,255]; 0 is black, while 255 is white;

Dynamic threshold: The average smooth filtering edge length and threshold are required. Values between the thresholds within 5-40 are good choices. The larger the threshold is, the smaller the extraction area is.

Automatic threshold: Just fill in the Gaussian filter standard deviation. The larger the value is, the smaller the extraction area is. The range is (0,100).

Blob Extract						×
Original Image Result Image	Params Resu	lt				
Contours Number: 2716	* Tool Name	blob				
	Extract Type	AutoThreshold				
	Sigma	- 20	+			
	Select Polarity	BlackOnWhite				
	Filter Params	Add				
	Select Property	Select Range	Low Value	High Value	Enable	Handle
			1	No Data		
	Run					Save
Figure 4.2.10 Autor	natic Th	reshold				
Blob Extract						×
Original Image Result Image						
	Params Resul					
Contracts Numer: State	* Tool Name	blob				
	Extract Type Low Threshold	Threshold				
	High Threshold	- 10	+			
	Select Polarity	BlackOnWhite	Ŧ			
	Filter Params	Add				
	Select Property	Select Range	Low Value	High Value	Enable	Handle
	select Property	Select Range		Hign Value	chable	nancie
and the second s			1	vo ovia		
the second se						

Figure 4.2.11 Hard Threshold

Save

Blob Extract						×
Original Image Result Image	Params Resu	it				
Contours Number: 1134	* Tool Name	blob				
	Extract Type	DynThreshold				
	Length Of Filter Mask	- 501	+			
	Threshold	- 40	+			
	Select Polarity	BlackOnWhite				
	Filter Params	Add				
	Select Property	Select Range	Low Value	High Value	Enable	Handle
and the second se			N	o Data		
Althe Contraction of the second						
	Run					Save

Figure 4.2.12 Dynamic Threshold

After the interface outputs processing results, they can be further filtered.

Area size filter: You may select "Area" as the attribute, and select "Include" or "Exclude" for the range. Set the size of the area filter, and select "Enable" to get filtered results.

Zone filter: Select "CenterX/CenterY" as the attribute, and select "Include" or "Exclude" for the range. Set the coordinates of the zone, and select "Enable" to get filtered results.

4.2.10 2.5D Space Ranging

The 2.5D spatial ranging tool is used for label positioning and adjusting the camera's photo pose.

Before the first run, visual calibration is performed, please select "Eye-in-hand hand" as the calibration type. After the calibration, create a new project and set the calibration file for the project.

Next, select the tool and create the reference table. Select the target size, camera pixels, camera lens, etc., check "Set Standard Plane", and click "Run" to set the plane where the current template item is located as the standard plane. Open the robot APP, fill the robot's photo pose into the corresponding position, save and close the tool.

After the standard plane is set, re-enter the tool editor, uncheck "Set standard plane or not", save and close the tool. After adjusting the position and pose of the item or camera, take a picture again and run the tool to calculate the relative change in pose between the item and the camera, and the software will directly return the new pose of the robot.

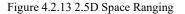
Target: reference for label positioning, divided into: 50*50mm, 100*100mm.

Pixels: the resolution of the camera, divided into 500w and 1200w.

Lens: camera lens focal length, which is divided into 8mm and 16mm models.

Robot photo coordinates: establish the coordinates of the standard plane when taking photos.

2.5D Measure Depth		×
Original Image Result Image	* Tool Name	250 0
	Select ALignMark	AlgrMark_50*50mm v
	Select CameraPiexl	Dup_Camera_500w V
	Select CameraLens	Cameral.ens_Brum v
	Robot Position	5 StandardPlane
	RobotX	- 0 +
	RobotY RobotZ	- 0 + - 0 +
	RobotRx	- 0 +
	RobotRy	- 0 +
	RobotRz	- 0 +
	Pose	
	Run	Same



4.3 Project Saving

After completing all operations in Chapter 4.1, you may choose to finish the editing of the project immediately by clicking "Save" to save the project configuration file; you may also choose to add the tools in Chapter 4.2. After completing the operations in Chapter 4.2, you may choose "Save" to save the project; if the user chooses to close the project, the project currently being edited will not be saved and the interface will switch to the homepage.

Chapter 5 Camera Management

In camera management, you can see information of the camera currently connected to the software, including camera name, camera IP, camera brand, and camera status.

Earces Canness Suppose Canness Suppose Suppose<	ens 2D					JAKA
DOJTHINK DSGP\$20201011 172.30.1.132 DOJTHINK Cese 2 DOJTHINK DSGP\$20201143 172.30.2.14 DOJTHINK Cese 2	ľ	Camera Management				
DOTHHINK DSGP502001011 172.30.1.132 DOTHHINK DOTHHINK DotHINIK DotHINIK <thdothinik< th=""> DotHINIK DotH</thdothinik<>		Camera name	Camera IP	Camera brand	Camera state	Handle
DOJTHINK D5GP50201148 172.30.2.214 DOJTHINK CGene 2	l					
		DO3THINK DSGP502001148	172.30.2.214	DO3THINK	Close	2

Figure 5.1.1 Camera Management

Click \checkmark to modify camera parameters.

Capture method: single-frame capture (one-shot); continuous capture (real-time);

Target image format: Mono8 (black and white), and BGR24 (color);

Light source switch: Off, On, Flashlight;

Exposure: Adjust the camera exposure, within the range of [0, 100,000,000];

Magnification: Adjust the camera magnification, within the range of [0,15];

White balance: Click white balance to correct the color temperature.

Edit camera information

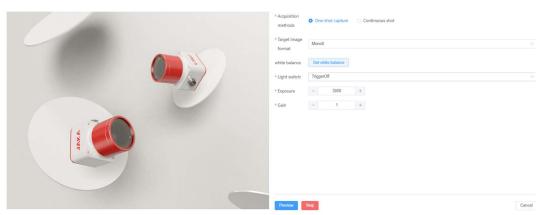


Figure 5.1.2 Camera Configuration

Chapter 6 Visual Calibration

Home							_
	Vision	calibration					
Project							
Camera	<u>#</u>	Calibration Name	Calibration Type	Calibration camera	Calibration Time	Calibration Status	Handle
	1	test	HandEye_EyeInHand	DO3THINK DSGP502001011	2022-09-28 10:06:42	true	Ø. 🗎
Calibration	2	1010	HandEye_EyeInHand		2022-10-10 10:37:46	true	۵ 📾
Connect	3	10101	HandEye_EyeInHand		2022-10-10 11:32:10	true	۵ ۵
Setting	4	10102	HandEye_EyeInHand		2022-10-10 16:20:40	true	۵ 8
	5	1011	NPoint_EyeInHand	DO3THINK DSGP502001011	2022-10-12 10:48:48	true	¢ 🖻
	6	1012	NPoint_EyeInHand	DO3THINK DSGP502001011	2022-10-12 13:36:14	true	۵ 📾
	7	颜色	NPoint_EyeInHand	DO3THINK DSGP502001011	2022-10-13 09:55:49	true	2 8
	8	25c	HandEye_EyeInHand	DO3THINK DSGP502001011	2022-10-13 14:23:39	true	e. 8
	9	9n	NPoint_EyeInHand	DO3THINK DSGP502001011	2022-10-13 14:27:54	true	¢ 8
	10	复合机器人	HandEye_EyeInHand	DO3THINK DSGP502001011	2022-10-14 10:37:58	true	2 8

6.1 Visual Calibration Management Interface

Figure 6.1 Calibration Management Interface

As shown in Figure 6.1, it is the interface of visual calibration file information where all existing calibration file information will be displayed, including serial numbers, calibration file names, calibration types, camera used to calibration, calibration time, calibration status, and corresponding operations.

6.1.1 New Calibration

Click "Add" to display the interface in Figure 6.1.1-1 and Figure 6.1.1-2.

Figure 6.1.1-1 Calibration Parameter Configuration Interface



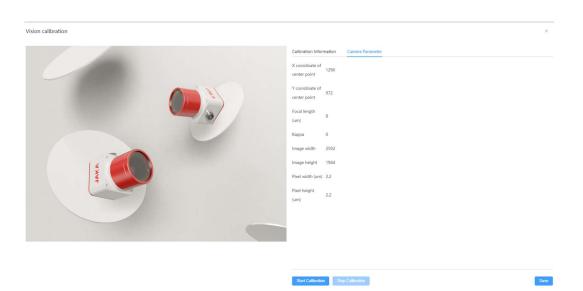


Figure 6.1.1-2 Calibration Parameter Configuration Interface

Tabl	le	6.1	
1001	•••	0.1	

Name	Definition	Note
Calibration Name	Customize the current calibration file name	Support Chinese characters, letters, and numbers
Calibration Camera	Select the camera used for calibration	If there is no camera online, the list will be empty
Calibration Type	 Eye-in-hand N-point calibration: N-point calibration with the camera installed on the robotic arm; Eye-to-hand N-point calibration: N-point calibration with the camera installed on a fixed support; Length and area calibration: You may use it when N-point calibration is difficult to perform; Eye-in-hand hand-eye calibration: The camera is installed on the end of the robot. You may use it when high precision is needed; Eye-to-hand hand-eye calibration: The camera is installed on a fixed support outside the robot. You may use it when high precision is needed; 	 The preferred methods of calibration are eye-inhand N-point calibration and eye-to-hand N-point calibration. Choose according to camera installation position. N-point calibration is easier to perform and quite precise. Hand-eye calibration is usually used for composite robots. Length and area calibration is commonly used when the preceding methods cannot be performed.



Calibration Board Size		Select the type according to the calibration board	The size of the calibration board is the edge length of	
		used in calibration;	the black square on it	
			When choosing Manual Demonstration Calibration	
			Point, you need to input the server port number. The	
			corresponding robot App is shown in Figure 6.1.3, in	
		Manual Demonstration Calibration Point refers to	which Home Point is the capturing point. The	
		demonstrating the position of each calibration point	calibration board is at the center of the camera view	
Calibratio	n Mathad	to the robot in advance;	when in the Home Point;	
Calibratio	n Method	Automatic Planning Calibration Point refers to	When choosing Automatic Planning Calibration	
		demonstrating the initial point to the robot and put	Point, you need to input robot the IP address and	
		the calibration board at the center of the camera view.	demonstrate the first point, so that the calibration	
			board will locate in the center of the camera view.	
			And then adjust the exposure to have clear-cut	
			contrast as shown in Figure 6.1.2;	
		The robot port number needs to be consistent with		
Server po	rt number	this port number	/	
Robot II	address	IP address of the robot	/	
			The default value is 1, and it can be adjusted	
			according to the actual situation. If the	
		Used in Automatic Planning Calibration Point,	calibration board is outside the view during	
Movem	ent step	indicating the step of the robot's every movement in	movement, the coefficient can be gradually	
coeff	icient	calibration	reduced (by 0.1 each time) until the calibration	
			board is fully visible in different positions of the	
	D' 1			
	Pixel	2.2um by default	This can be looked up using the camera model	
Camera parameter list	width		number	
	Pixel	2.2um by default	This can be looked up using the camera model	
	height		number	
	Focal	8mm by default	Input the focal length of the lens you have chosen	
	length			
	Kappa	Camera distortion, which is 0 by default	The distortion value is generally 0. Input the value	
			from the supplier	

JAKA。市卡

Camera parameter list	Image width	2592 by default	This can be looked up using the camera model number
	Image height	1944 by default	This can be looked up using the camera model number
	Center point X coordinate	1296 by default	Half of the image width
	Center point Y coordinate	972 by default	Half of the image height

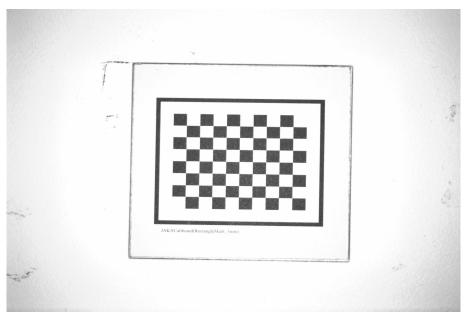


Figure 6.1.2 The calibration board is in the center of the camera view

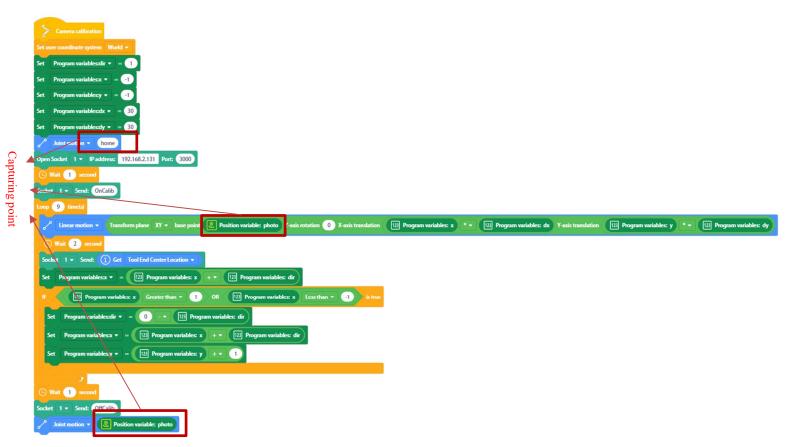


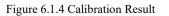
Figure 6.1.3 Manual Calibration Program



6.1.2 Calibration Result

After the calibration is completed, the result will be displayed in the image display window. If the calibration is successful, click "Calibration Complete", and the calibration file will be saved. If the calibration fails, check the calibration parameters and the robot calibration points, and then start over.

Vision calibration	×
Calibration result: Camora Matrix RMS:0.100	Calibration Information Camera Parameter *Calibration Name Robot
Camera Translate RMS:0.390 Camera pixel Camera conversion	Calibration camera DO3THINK DSGP5/2001011 ~ · Calibration Type Eye-In-Hand N-point calibration ~ ·
	Dimension of calibration RedangleMark_3mm ~ target Calibration method Manual calibration point set
	* The IP address of the robot * Coefficient of roovement - 0.5 + step



Start Calibration Stop Calibration

Save

Chapter 7 Communication Settings

In the communication settings interface, you can see all current communication files, with information such as the communication type, IP, Port, Date, etc.

7.1 Communication File Adding

Click "Communication Settings"-"Add" to add a new communication file.

2D						J	AKA
	Connect Config						
	Communication Name	Communication Type	IP	Port	CreateTime	Handle	
	test	TcpServer	172.30.1.253	3000	2022-11-02 11-23-06	e.	8
L	test2	TcpServer	172.30.0.232	3000	2022-11-02 11-23-12	Q_	8
L	test3	TcpServer	172.30.3.193	5000	2022-11-03 05-15-58	a	8
L	tcp	TcpServer	172.30.1.253	3000	2022-10-08 09-25-28	a.	8
L	tcp-b	TcpServer	172.30.3.193	3000	2022-09-15 10-39-34	0	8
L	tcp+c	TcpServer	172.30.3.193	3000	2022-09-15 13-23-20	e.	8
L	test222	TcpServer	172.30.0.232	3000	2022-10-19 07-54-30	Ø.	8
L	test-long	TcpServer	172.30.0.232	3000	2022-10-21 05-16-51	e	8
L	ten01	TcpServer	172.30.0.232	3000	2022-11-03 14-52-09	e.	8
L	ten02	TcpServer	172.30.0.232	3000	2022-11-03 14-52-14	2	8
L	ten03	TcpServer	172.30.0.232	3000	2022-11-03 14-52-20	e.	8
L	ten04	TcpServer	172.30.0.232	3000	2022-11-03 14-53-03	e.	8
L	ten05	TcpServer	172.30.0.232	3000	2022-11-03 14-52-58	e.	8
L	ten06	TcpServer	172.30.0.232	3000	2022-11-03 14-52-54	e	8
L	ten07	TcpServer	172.30.0.232	3000	2022-11-03 14-53-42	Q.	8
L	ten08	TcpServer	172.30.0.232	3000	2022-11-03 14-53-40	Q	8
-	ten09	TcpServer	172.30.0.232	3000	2022-11-03 14-53-59	0_	B

Figure 7.1 Communication file adding

7.2 Communication File Editing

Enter the communication name, communication type, IP, Port, and other information in the communication settings interface.

Click the communication command "Add" to add a communication command (only letters and numbers), select the naming type in the table, and

fill in the name to add a new name, as shown in Figure 7.2.

Check "Enable" of the command line to enable the corresponding command;

Click "Delete" in the command line to delete the corresponding name.

Click "Save" to save the communication file.

Communication name: Customize the current communication file name, with Chinese characters, letters, and numbers supported;

Communication type: This version supports TCP communication. Users can choose to run the project as the server or client;

IP: IP address;

Port: port

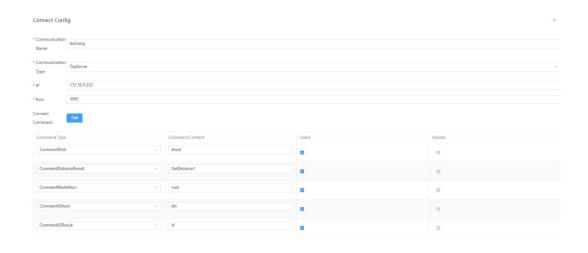


Figure 7.2 Communication file editing

Chapter 8 System Settings

The system settings include three parts: software version, picture files, and log files.

8.1 Software Version

The software version interface displays the current software version and the time of the last update (as shown in Figure 8.1); this interface also supports online upgrading.

Click "Select a file", and select the latest software package from your local computer. After the software package is uploaded, click "Start Upgrading" to update the software online. As shown in Figure 8.1-2.

Lens 2D	
🛆 Home	Version Image File Log File
Project	Version 2.0.1.1
🔍 Camera	Update 2022-11-03 09:42:28 Time
⊖ Calibration	Upgrade 🗅 Select File 🌊 Start Upgrade
Connect Connect	
Setting	
	Figure 8.1-1 Software version
Lens 2D	Figure 8.1-1 Software version
Lens 2D	Figure 8.1-1 Software version
A Home	Version Image File Log File
A Home	Version Image File Log File Version 2.0.1.1 Update 2022-11-03 09:42:28
 ☐ Home ☐ Project @ Camera 	Version Image File Log File Version 2.0.1.1 Update Time 2022-11-03 09:42:28
 △ Home ⇒ Project ∞ Camera ○ Callbration 	Version Image File Log File Version 2.0.1.1 Update Time 2022-11-03 09:42:28 Upgrade C) Select File
 △ Home ⇒ Project ∞ Camera ○ Calibration ∞ Connect 	Version Image File Log File Version 2.0.1.1 Update Time 2022-11-03 09:42:28 Upgrade C) Select File



8.2 Image File

Check "System Settings-Image File-Save the latest 100 images" to let the system automatically save images during project operation. At present, only 100 images can be saved.

JAKA节卡 Lens 2D 🛆 Home Project 3 Camera O Calibratio @ Connect 2022-09-23 12:19:1 20220923121912328.in Setting 20220923121957164.ipc 2022-09-23 12:19:5 2022-09-23 12:20:0 2022-09-23 12:19 0220923121926614 in 2022-09-23 12:19:2 8 8 8 20220923121850918.jpg 2022-09-23 12:18:51

The image files are divided into two types: original images and processed images, both of which can be previewed and downloaded in this interface.

Figure 8.2 Image file

8.3 Log files

You can choose to save 7 or 30 days of log files. Users can also download system logs in this interface.

Lens 2D			JAKA
ome	Version Image File Log File		
oject	Save 7 Days O Save 30 Days		
amera	*	File Name	Time
ration	1	log_20221008.log	2022-10-09 06:51:29
100011	2	log_20220923.log	2022-09-23 13:52:07
nect	3	log_20221101.log	2022-11-02 09:25:42
ng	4	log_20221104.log	2022-11-04 09:57:01
	5	log_20221019.log	2022-10-20 07:36:05
	6	log_20220913.log	2022-09-13 13:50:01
	7	log_20221017.log	2022-10-19 11:34:58
	8	log_20220919.log	2022-09-21 11:46:31
	9	log_20221025.log	2022-10-26 05:56:51
	10	log_20220914.log	2022-09-14 13:52:17
	11	log_20220921.log	2022-09-22 10:21:05
	12	log_20210702.log	2021-07-02 15:10:14
	13	log_20221102.log	2022-11-03 05:25:37
	14	log_20221020.log	2022-10-21 07:13:58
	15	log_20220926.log	2022-09-27 06:00:53
	16	log_20221014.log	2022-10-17 06:10:24
	17	log_20221021.log	2022-10-24 14:33:11
8	18	log_20210427.log	2021-04-27 18:19:26
*	19	log_20221009.log	2022-10-10 05:19:39
«	20	log_20220922.log	2022-09-22 12:09:58

Figure 8.4 Log file

Save

Chapter 9 Visual Application Case

9.1 Template Matching, Positioning, and Capturing

This case is the implementation of simple positioning and capturing functions.

The steps are as follows:

Vision calibration

Step 1: Visual calibration: in the visual calibration module, click "Add", customize the calibration name, and select the calibration camera. Automatic calibration is available for this project, and the calibration type is selected according to the condition of the site. Select "Rectanglemark_3mm" which is the size of the attached calibration board, and "Automatic Planning Calibration Point" for the calibration method. Fill in the robot IP address, and set the movement step coefficient as 1 (adjustable according to the actual situation. The coefficient can be gradually decreased if the calibration plate is out of the field of vision during the robot movement, until the calibration board is completely visible in different positions of the view after 9 times of image taking).

Note: There will be slight differences in the robot program corresponding to different calibration types, as shown in Figure 9.1.8.

Calibration Information Camera Parameter
Calibration camera DD3THINK DBGP502001011 ~ Calibration Type Eye-In-Hand N-point calibration ~
Dimension of calibration RectangleMark_3mm target Calibration Calibration method Manual calibration point set
The IP address 172.30.0.129 172.30.0.129 100 100 10 1 1 1 1 1 1

Figure 9.1.1 Visual Calibration

Step 2: Prepare the visual project flowchart, as shown in Figure 9.1.2. See section 4.2.2 for the specific settings of the template matching tool.

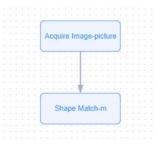


Figure 9.1.2 Visual Flowchart

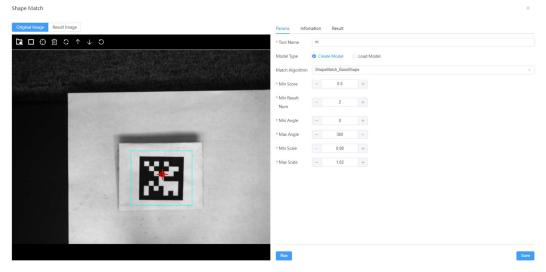


Figure 9.1.3 Template Matching

Step 3: Communication settings: in the communication settings module, click "Add". In this flowchart, only two commands are required, namely "Camera Capture" and "Number of Templates", as shown in Figure 9.1.4.

Connect Conf	ïg				×
* Communication Name	Communication1				
 Communication Type 	TcpServer				
* IP	172.30.0.232				
* Port	3000				
Connect Command	Add				
Command Type		Command Content	Used	Handle	
CommandShot		shoot		8	
CommandMode	elNum v	number	8	8	

Figure 9.1.4 Communication Settings

Save

Step 4: Project settings: in the project management interface, select the item you need to set from the project list, and click the setting icon to enter the project setting interface. Select the calibration files and communication documents that have been set, and then save them, and set the visual base point.

How to set a visual base point:

1. Enter the homepage and run the project;



- 2. Use the robot APP to send a capture command;
- 3. Check the results of the template matching tool in the result bar, as shown in Figure 9.1.5, and record X, Y, and Rz;
- 4. Stop the project;
- 5. Open the project settings, fill in base point X, base point y, and base point A with the recorded values;
- 6. Click "Enable Visual Base Points", save, and exit.

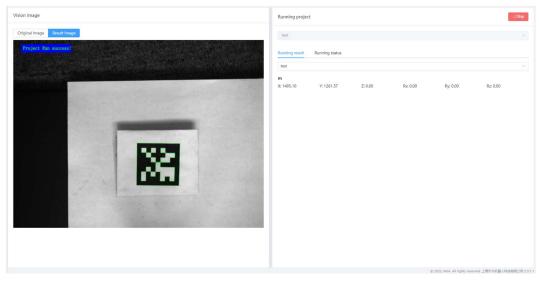


Figure 9.1.5 Project Running Homepage

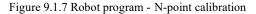
Lens 2D				JAKAI#+	•
🛆 Home	Project parameters setting			Save Close	
Project	Vision calibration Vision calibration				
🕲 Camera	Communication file Communication1				
 Calibration 	Rectify the image				
Connect	Vision base setting Compensation	factor setting			
58 Setting	Enable vision base				
	Vision base	Base point value			
	Base point X	- 1495.1	+		
	Base point Y Base point A	- 1261.57	+		
	Enable vision absolute coordinate				
	Robot base	Base point value			
	Base point X	- 0	+		
	Base point Y	- 0	+		
	Base point Z	- 0	+		
Ø	Base point RX	- 0	+		
8 0 6	Base point RY Base point RZ	- 0	+		
«	man house an	Let.			

Figure 9.1.6 Interface to Set a Project



Step 5: Write a robot program. When using the N-point calibration, the robot program is as follows:

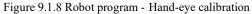
> Postforming tetching
Sot user coordinate system World +
OpenSocket 1 - Paddress 172300.129 Prote 5000 Set the robot as the client, and ensure that the IP and ports are consistent with visual projects
Loop 🕢 timet)
/ / Side front of the control of the
set 📭 set 🚥 Send a capture command, which needs to be consistent with the camera capture command of the visual project
Sold 1 - Seet Combo
set Program variablessum • = Socket 1 • Receive waiting time 0 3 Receive the number of targets. The result is a string
Enter a formatted string String: Drogram variables: num Format: D Program variables: model number Convert the string to numbers
log Type MESSAGE - Log Content 😥 Program variable: nam
Loop 🔃 Program variables: model number time(s)
south 1 - Send time command to get the number of templates
Set Program variablessum • = Socket 1 • Receive waiting time: 0 3 Receive the number of targets, and the result is a string
Set Program variablespose • = Socket 1 • Receive array array length: 3 Waiting time: 0 3 Receive the position coordinates of targets
Linear motion Transform plane Xf base point Position variables // Zauis notation Array: [1] Program variables: pose Access subscript: 3 Xauis translation Array: [1] Program variables: pose Access subscript: 1
Ketathe linear motion (1993) Move to the target position and capture
2 ² St digital output Toolend • [001+ tobe On •]
(C) Wait (1) second



Note: Before you obtain the position coordinates of the template, the number of templates must be obtained.

When using Hand-eye calibration, the robot program needs to add "Get Tool End Center Location":





The editing of "Input format string string" is shown in the following figure:

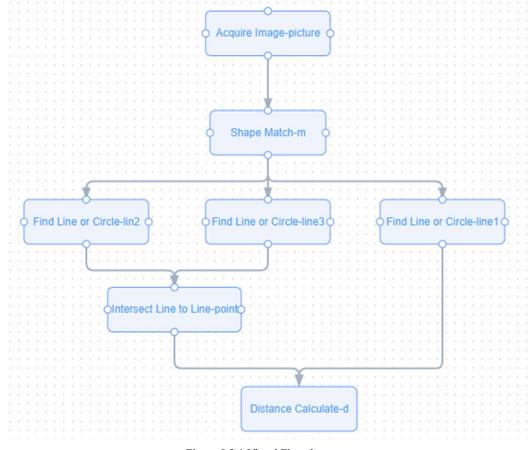
String formatting editing	
Quantity 1	
Array separator	
Cancel	Confirm

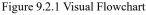
Figure 9.1.9 Enter the formatted string settings

9.2 Template Matching + Edge and Circle Identification

Here is an flow chart of realizing template matching, edges and circles identifying, and calculating the point-to-line distance.

Step 1: Set up each tool and draw the flowchart, as shown in Figure 9.2.1. The details of the tool settings refer to Chapter 4.





Step 2: Visual calibration: in the visual calibration module, click "Add", customize the calibration name, and select the calibration camera. Automatic calibration is available for this project. Select "Rectanglemark_3mm" which is the size of the attached calibration board, "Eye-In-Hand N-point calibration" for the calibration type and "Automatic Planning Calibration Point" for the calibration method. Fill in the robot IP address, and set the movement step coefficient as 1 (adjustable according to the actual situation. The coefficient can be gradually decreased if the calibration plate is out of the field of vision during the robot movement, until the calibration board is completely visible in the view after 9 times of image taking);



Vision calibration		×
	Calibration Information Camera Parameter	
	Name Calibration Camera DOSTHINK DSGP52201011	
	Calibration Eye-In-Hand N-point calibration Type	
	Dimension of calibration RectangleMark_3mm target	
	Calibration Calibration point set Manual calibration point set	
	* The IP address 172 30 0 153 of the robot	
	* Coefficient of movement - 1 + step	
	Stat Collection Stor Collection	Sam

Figure 9.2.2 Visual Calibration

Step 3: Communication settings: in the communication settings module, click "Add". In this flowchart, four commands are required, namely "Camera Capture", "Number of Templates", "Number of Intersections", and "Distance Calculation Result" as shown in Figure 9.2.3:

Connect Confi	g			×	
* Communication Name	test				
Communication Type	TcpServer				
• IP	172 30.0 153				
* Port	3000				
Connect Command	Add				
Command Type		Command Content	Used	Handle	
CommandShot		shoot	8	6	
CommandDistar	cceResult ~	dn		0	
CommandBlobN	lum: v	distance	8	8	
CommandMode	Num	num	8	ล	

Figure 9.2.3 Communication Settings

Step 4: Project settings: in the project management interface, select the item you need to set from the project list, and click the setting icon to enter the project setting interface. Select the calibration files and communication documents that have been set, and then save them, and set the visual base point.

How to set a visual base point:

Save



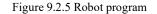
- 1. Enter the homepage and run the project;
- 2. Use the robot APP to send a capture command;
- 3. Check the results of the template matching tool in the result bar, and record X, Y, and Rz
- 4. Stop the project;
- 5. Open the project settings, fill in base point X, base point y, and base point A with the recorded values;
- 6. Click "Enable Visual Base Points", save, and exit.

Project parameters setting		Save Close			
Vision calibration Vision calibration					
Communication file test					
lactify the image 🕘					
Vision base setting Compensation fa	Non base setting Compensation factor setting				
Enable vision base					
Vision base	Base point value				
Base point X	- 0 +				
Base point Y	- 0 +				
Base point A	- 0 +				

Figure 9.2.4 Interface to Set a Project

Step 5: Write a robot program.

> Distance Test
Open Socket 1 • IP address: 172.30.3.153 Port: 3000 Set the robot as the client, and ensure that the IP and ports are consistent with visual projects
Loop 4 time(s) Socket 1 • Send: shoot © Wait 1 second
Socket 1 v Send: num Get the number of targets identified
Set Program variables:num • = Socket 1 • Receive waiting time: 0 s Receive the number of targets. The result is a string
Enter a formatted string String: 🖭 Program variables: num Format: 🔃 System variables: ModelNum Convert the string to a number
If U System variables: ModelNum Greater than • 0 is true When the number of templates is greater than 0, exit the loop
Socket 1 - Send: dn Send the command to get the number of distances
Set System variables:2 • = Socket 1 • Receive waiting time: 0 s Receive result of distance calculation
Wait 1 second
Socket 1 - Send: distance Send the command to get distance calculation results
Set Program variables:Distance = Socket 1 • Receive waiting time: 0 s Receive the point-to-line distance



The editing of "Input format string string" is shown in the following figure:

String formatting editing	
Quantity 1	
Array separator	
Cancel Confirm	

Figure 9.2.6 Enter the formatted string settings

Note: Before obtaining the position coordinates of the template position or distance calculation results, the number of distances or templates must be obtained.

9.3 Color Recognition + Position Capture

Vision calibration

This case is an implementation to sort items with the same shape but different colors. The steps are as follows:

Step 1: Visual calibration: in the visual calibration module, click "Add", customize the calibration name, and select the calibration camera. Automatic calibration is available for this project, and the calibration type is selected according to the condition of the site. Select "Rectanglemark_3mm" which is the size of the attached calibration board, and "Automatic Planning Calibration Point" for the calibration method. Fill in the robot IP address, and set the movement step coefficient as 1 (adjustable according to the actual situation. The coefficient can be gradually decreased if the calibration plate is out of the field of vision during the robot movement, until the calibration board is completely visible in different positions of the view after 9 times of image taking);

Note: There will be slight differences in the robot program corresponding to different calibration types, as shown in Figure 9.1.8.

	Calibration Information Camera Parameter * Calibration Name test
	Calibration DO3THINK DSQP502001011 Camera Calibration Eye-In-Hand N-point calibration V
Part of the second seco	Dimension of calibration RectangleMark_3mm v target Calibration point set method Automatic calibration point set
	* The IP address of the robot * Coefficient of recoverient - 1 + step

Figure 9.3.1 Visual Calibration

Start Calibration Stop Calibration

Save

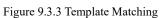
Step 2: Prepare the visual project flowchart, as shown in Figure 9.3.2. The details of template matching and color identification settings refer to Chapter 4.

	Acquire Im	age-picture
		,
1	Shape M	Match-m
1		
ļ		

Figure 9.3.2 Visual Project

Save

Shape Match				×
Original Image Result Image	Params	Infomation Result		
The model Area is 1239.000	#	х	Y.	分数
Height is 130.000 Width is 111.000	1	1430.16	389.68	0.83
neight is 150.000 with is 111.000	2	1324.20	141.72	0.82
•				



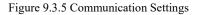
Select Space @Picture Color Please draw at most three colors with clicte Color Please draw at most three colors with clicte View 1340.21 132.54 31.48 0 0 blue 1521.64 122.51 30.94 0 0 red 1428.42 382.13 29.14 0 0	I Image Result Image	* Tool !	Name	color				
ColorName Center X Center Y Radius Enable Handle yellow 1340.21 132.54 31.48 Image: ColorName Image: ColorName	C ↓ ↑ ⊅ D	Select 1	t Space	@Picture				
yetow 1340.21 132.54 31.48 C G blue 1521.64 122.51 30.94 C G		Color		Please draw at mos	t three colors with ci	cle		
blue 1521.64 122.51 30.94 🖬			orName	Center X	Center Y	Radius	Enable	Handle
		yeli	llow	1340.21	132.54	31.48		ŧ
red 1428.42 382.13 29.14 🗹 🖆		blue	Je	1521.64	122.51	30.94		â
		red	d	1428.42	382.13	29.14		
		red	đ	1428.42	382.13	29.14		8

Figure 9.3.4 Color Recognition

To check whether the color recognition is successful, you may set a huge search area. Click "Run", and check the recognition results. However, when saving the color recognition module tool, the search box must be inside the template.

Step 3: Communication settings: in the communication settings module, click "Add". In this flowchart, four commands are required, namely "Camera Capture", "Number of Templates", "Number of Colors Recognized", and "Color Recognition Result" as shown in Figure 9.3.5:

Connect Config			×		
* Communication Name					
Communication TcpServer Type					
* IP 172.30.3.193	172.30.3.193				
* Port 3000					
Connect Add					
Command Type	Command Content	Used	Handle		
CommandShot	shoot	8	Ø		
CommandColorNum	v clolornum	•	ē		
CommandColorResult	× r		0		
CommandModelNum	< Inum	8	8		



Step 4: Project settings: in the project management interface, select the item you need to set from the project list, and click the setting icon to enter the project setting interface. Select the calibration files and communication documents that have been set, and then save them, and set the visual base point.

How to set a visual base point:

- 1. Enter the homepage and run the project;
- 2. Use the robot APP to send a capture command;
- 3. Check the results of the template matching tool in the result bar, and record X, Y, and Rz
- 4. Stop the project;
- 5. Open the project settings, fill in base point X, base point y, and base point A with the recorded values;
- 6. Click "Enable Visual Base Points", save, and exit.

Project parameters setting			Save
Vision calibration Vision calib	oration		
Communication file test			
Rectify the image			
Vision base setting Comp	ensation factor setting		
Enable vision base			
Vision base	Base point value		
Base point X	- 0 +		
Base point Y	- 0 +		
Base point A	- 0 +		

Figure 9.3.6 Project settings interface



Step 5: Write a robot program. When using the N-point calibration, the robot program is as follows:

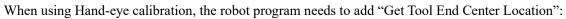
> Celer classification	
Set war coodhate system Wadd =	
Open Socket 1 Paddeese 172203.193 Post 2000 Set the robot as the client, and ensure that the IP and ports are consistent with v	visual projects
Z 2 Joint motion - Photo Point Capturing point	
see 12 see 🚥 Send a capture command, which needs to be consistent with the camera capture	
⊙ Wat (2) word	
sodet 1. Sond man Get the number of targets identified	
Set Program variablesmum • = Socket 1 • Receive waiting time: () 5 Receive the number of targets. The result is a string	
Enter a formatted string String: 🖭 Program variables: num Format: 💷 Program variables: model number Convert the string to numbers	
Log Type MESSAG = Log Content (2) Program variables: nun	
Long [10] Program variables: model number inmedia	
some and some and to get the number of templates	
Set Program variables.num + = Socket 1 + Receive waiting time: 3 Receive the number of targets, and the result is a string	
Set Program variablespose • = Socket 1 • Receive array array length: 3 Waiting time: 0 5 Get the coordinates of target items	
Linear motion Transform plane XY base point 🙆 Position variable: jd Z-axis rotation Array: [*] Program variables: pose Access subscript: 3 X-axis translation Array: [*] Program variables: pose Access subscript: 0 Y-axis translation	tion Array: [*] Program variables: pose Access subscript: 1
💢 Set digital oxique Tool and + DO1 + wobe On +	
set 1+ set command to get the number of colors recognized	
Set Program warlablescolormum • = Socket 1 • Receive waiting time: 0 s Receive color recognition results	
some 1 some C Send the command to get the color recognition results	
Set Program variables.color result • = Socket 1 • Receive waiting time 0 3 Receive color recognition results	
stang Comparation 😰 Program variables: color result 💿 Inque to 🔹 💿 Innue If the result is red	
Log Type: MESSAGE + Log Contante: B: Program variables: color result	
Nove to red sorting points, and release the item	
2 St digitationing Tool end + D01+ table OF+	
🕑 Weit 🕕 second	
string Comparation 🖭 Program variables: color result 🕐 Equal to • 🕐 Is the result is yellow	
Log Type: MESSAGE + Log Content: (F): Program variables: color result	
Move to yellow sorting points, and release the item	500
2, Set digital output Toolend + D01 + to be Off +	

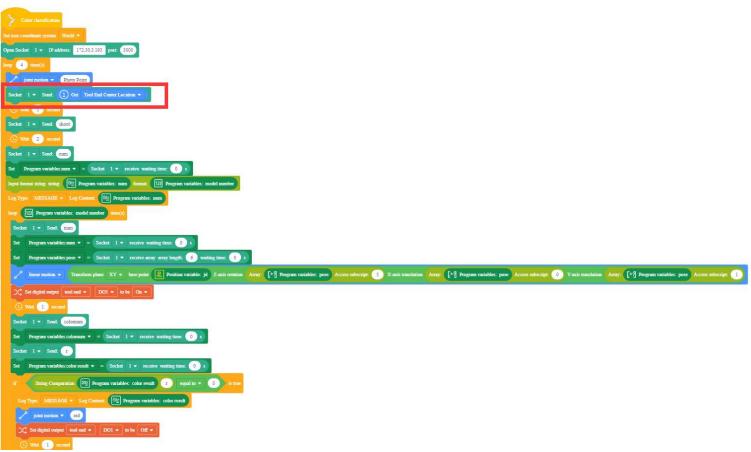
Figure 9.3.7 Robot program - N-point calibration

Note: Before obtaining template position coordinates or color recognition results, you must obtain the number of templates or colors recognized. The editing of "Input format string string" is shown in the following figure:

String formatting editing
Quantity 1
Array separator
Cancel Confirm

Figure 9.3.8 Enter the formatted string settings





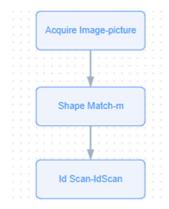


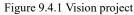
9.4 Identification via Positioning and Code Scanning

Positioning identification is to locate the product position through its features, then find the bar code position according to the product position, and finally scan the code, which can greatly improve the stability of code scanning. At the same time, when there are multiple bar codes in the view, it can accurately find the product with its features to reduce the interference of other bar codes.

The steps are as follows:

Step 1: Edit the visual project, as shown in Figure 9.4.1;





Use the template matching-m tool, select the product features, and complete the positioning function of the product, as shown in Figure 9.4.2; use the code scanning tool, and the template matching tool needs to be selected for available space, as shown in Figure 9.4.3; For the specific operation process, please refer to Chapter 4;



Figure 9.4.2 Template matching



Id Scan				×
Original Image Result Image		Params Re	sult	
		* Tool Name	IdScanj	٢
		Select Space	@Picture	
	the second se	Code Type	Code1D	
		Symbol Type	Codabar	
		Scan Type	JKIDQuick	
	JAKA Lens 2D	Code Polarity	dark	
	Constanting and a start of the second	Search Num	- 1 +	
		* TimeOut	- 1000 +	
	JAKA Lem 2D			
		Run		Save

Figure 9.4.3 Scan code identification

Step 2: Communication settings: in the communication settings module, click "Add". In this flowchart, four commands are required, namely "Camera Capture", "Number of Templates", "Number of Colors Recognized", and "Color Recognition Result" as shown in Figure 9.4.4;

Connect Config	g			¢
* Communication Name	test			
* Communication Type	TcpServer			
	172.30.1.253			
Connect Command	Add			
Command Type CommandShot		Command Content shoot	Used	Handle
CommandIDNum	n Y	mn	•	0
CommandIDRess	ult ~	result	8	[®]
CommandModel	Num	n	•	8

Figure 9.4.4 Communication Settings

Step 3: Project settings: in the project management interface, select the item you need to set from the project list, and click the setting sicon to enter the project setting interface. Select the calibration files and communication documents that have been set, and then save them, and set the visual base point.

How to set a visual base point:

- 1. Enter the homepage and run the project;
- 2. Use the robot APP to send a capture command;
- 3. Check the results of the template matching tool in the result bar, and record X, Y, and Rz
- 4. Stop the project;
- 5. Open the project settings, fill in base point X, base point y, and base point A with the recorded values;
- 6. Click "Enable Visual Base Points", save, and exit.

Project parameters setting	
Vision calibration Vision calibration	
Communication file test	
Rectify the image	
Vision base setting Compensation fac	ctor setting
Enable vision base	
Vision base	Base point value
Base point X	- 0 +
Base point Y	- 0 +
Base point A	- 0 +
Enable vision absolute coordinate	
Robot base	Base point value
Base point X	- 0 +
Base point Y	- 0 +
Base point Z	- 0 +
Base point RX	- 0 +
Base point RY	- 0 +
Base point RZ	- 0 +

Figure 9.4.5 Interface of Project Settings

9.5 Composite Robot Positioning Grabbing

This case is suitable for composite robot positioning and grabbing with the camera installed on the end of the robot.

Step 1: Visual calibration: in the visual calibration module, click "Add", customize the calibration name, select "Automatic Planning Calibration Point", and **select "Eye-in-hand hand" as the calibration type**. Select "Rectanglemark_3mm" which is the size of the attached calibration board, and select "Eye-in-hand hand-eye calibration" as the calibration method. Fill in the robot IP address, and set the movement step coefficient as 1 (adjustable according to the actual situation. During the movement of the robot, if the calibration board is beyond the view, the coefficient can be gradually decreased if the calibration plate is out of the field of vision during the robot movement, until in all images, the calibration board is completely visible in different positions of the view);

Vision calibration	×
	Calibration Information Camera Parameter Calibration Name Composite robot
	Calibration D03THINK DSGP52201011 ~ ~
	Calibration Eye-In-Hand N-point calibration ~
	Dimension of calibration RectangleMark_3mm ~
A MAR	target Calibration Manual calibration point set Calibration point set The IP address 192 168 1 190
	of the robot * Coefficient of movement - 0.5 + step

Figure 9.5.1 Visual Calibration

Start Calibration Stop Calibrati

Vision	calibratio

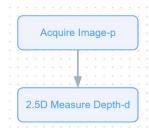
Calibration result:	Calibration Information Camera Parameter *Calibration Composite robot
Camera Matrix RMS:0.100	Name
Camera Translate RMS:0.380	Calibration D03THINK DSGP562001011 V
	Calibration Eye-In-Hand N-point calibration <
	Dimension of
	calibration RectangleMark_3mm v
	target Calibration Calibration point set O Automatic calibration point set method
	* The IP address of the robot
	* Coefficient of
	step

Figure 9.5.2 Calibration Result

Save

Step 2: Create a visual project and save it. For project setting, in the project management interface, select the project in the project list, and click the setting icon ^(a) to enter the setting project interface. Select the calibration file that has been set up and save it.

Step 3: Setting vision editing and filling in the robot pose of photo location into the 2.5D special ranging tool, as shown in Figure 9.5.3 and 9.5.4. See section 4.2.10 for the specific settings of spatial ranging.





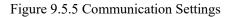
Colgnal Image Result Image	* Tool Name	250	×
	Select ALignMark	ALignMark_50*50mm	
	Select CameraPiexl	D _v p_Camera_560w	
	Select CameraLens	CarmeraLens_8mm	
		Is StandardPlane	
	Robot Position		
	RobotX	- 693.123 +	
	RobotY	- 33.949 +	
	RobotZ	- 498.165 +	
	RobotRx	- 93.675 +	
	RobotRy	- 10.248 +	
	RobotRz	- 19.85 +	
	Pose		
	•		
		_	
	Run	Sa	ve-



Step 4: Communication settings: in the communication settings module, click "Add". In this flowchart, only two commands are required, namely "Command shot" and "Command Model Number", as shown in Figure 9.5.5:



Connect Config	unnect Config				
* Communication Name					
* Communication TcpServer Type					
* IP 192.168.1.180	192.168.1.180				
* Port 3000	3001				
Connect Add					
Command Type	Command Content	Used	Handle		
CommandShot ~	shoot	8	8		
CommandModelNum	num	8	<u>a</u>		



Step 5: Project settings: in the project management interface, select the item you need to set from the project list, and click the setting item and icon to enter the project setting interface. Select the calibration files and communication documents that have been set, and then save them, and set the visual base point.

Step 6: Create a new location capture project (refer to 9.1). Note that the communication commands of the two projects cannot be the same.

Step 7: Write a robot program in Figure 9.5.6 and 9.5.7.

The editing of "Input format string string" is shown in the following figure:

String formatting edit	ing		
Quantity	1]
Array separator			
Ca	ancel	Confirm	

Figure 9.5.6 Enter the formatted string settings



Composite robot	
Generation 1.1 Pratters: 19231011133 per 6000 Set the robot as the client, and ensure that the IP and ports are consistent with visual pro-	jects
Capturing point	
Societ 1 + Send: (1) Get Tool End Center Location +	
Send a capture command of 2.5D special ranging, which needs to be consistent	
with the camera capture command of the visual project	
Set Tragets. The result is a string	
Input fannet sning sning: Deph calculation fannet 12 Program variables: Deph calculation fannet 12 Program variables: Deph var	
The Program valide: Dopping va	n
Z Boost modes - [1] Program variables: New Photos Vosition Move to new capture position by MoveL	
I TE Program variables: DeepNamber squal to * 1 a mos Societ 1 * Seed: (1) Get Tool End Center Location *	
Send a capture command of template matching, which needs to be	
consistent with the camera capture command of the visual project	
some 1. see an Get the identified target number	
Set Program variables modelslank + = Socket 1 + receive waiting toos: 0 1 Receive the number of targets. The result is a string	
tore III Program variables: model/kamber tameta	
Set Program variables: Carle + = Socket 1 + incerive anny anny benght 3 waiting time: 3 in Get coordinate of target position Set incernation + Transform plane XY + base point 2 Position variable: Los Access subscript 3 X-axis translation. Anny: [*] Program variables: Carle Access subscript 3 X-axis translation. Anny: [*] Program variables: Carle Access subscript 3 X-axis translation. Anny: [*] Program variables: Carle Access subscript 3 X-axis translation. Anny: [*] Program variables: Carle Access subscript 3 X-axis translation. Anny: [*] Program variables: Carle Access subscript 4 hours 1 Postan variables: Carle Access subscript 3 X-axis translation. Anny: [*] Program variables: Carle Access subscript 4 hours 1 Postan variables: 1 Postan var	
	Part Variables: Calca Access Subscript:
Move to new target position and grip	
	QC

Figure 9.5.7 Robot Program

Note: Before getting the template position coordinates or depth calculation result, you must get the template quantity or depth calculation quantity.