JAKA 节卡

Lens User Manual

JAKA Lens 2D

Version: V2.1

CAUTION:

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The pictures in this manual are for reference only, please refer to the actual product.

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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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.

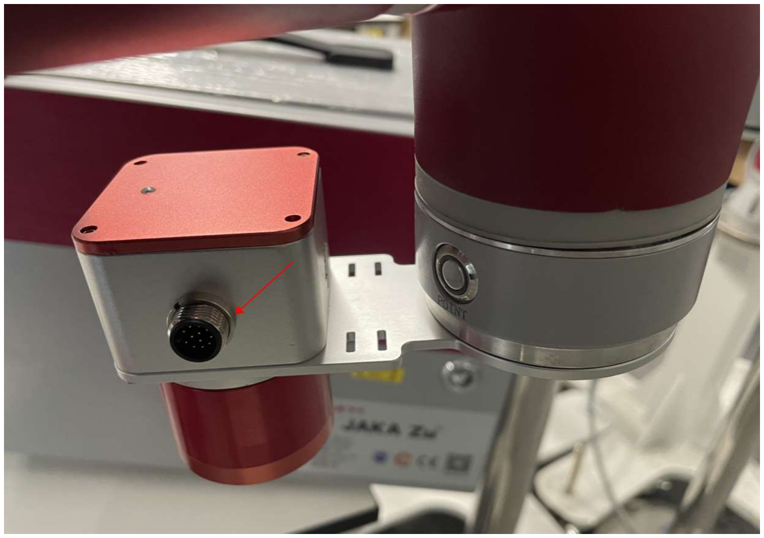

Figure 2.2.1

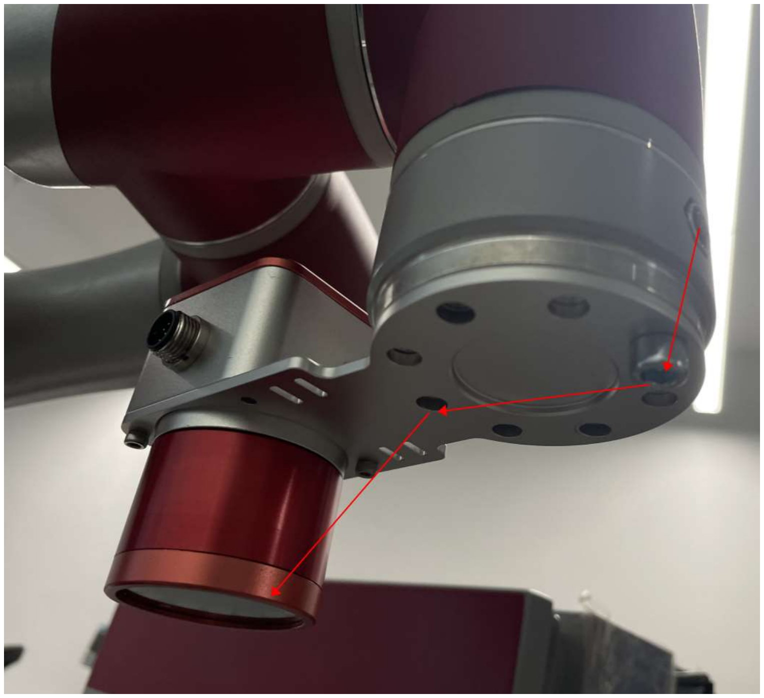

Figure 2.2.2

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.

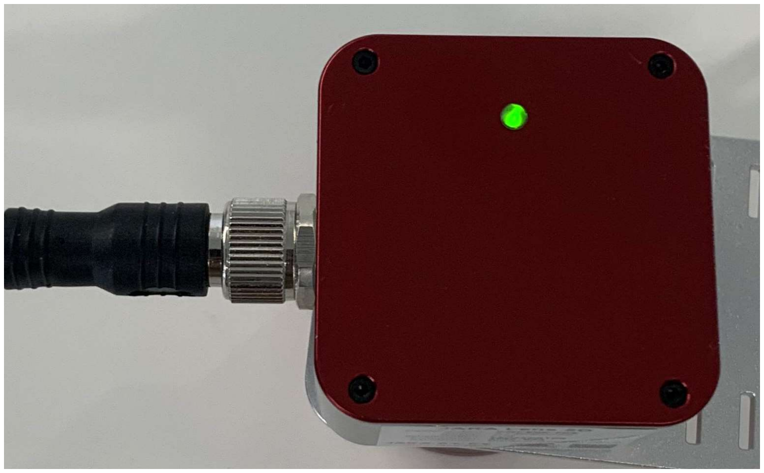

Figure 2.2.3

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.

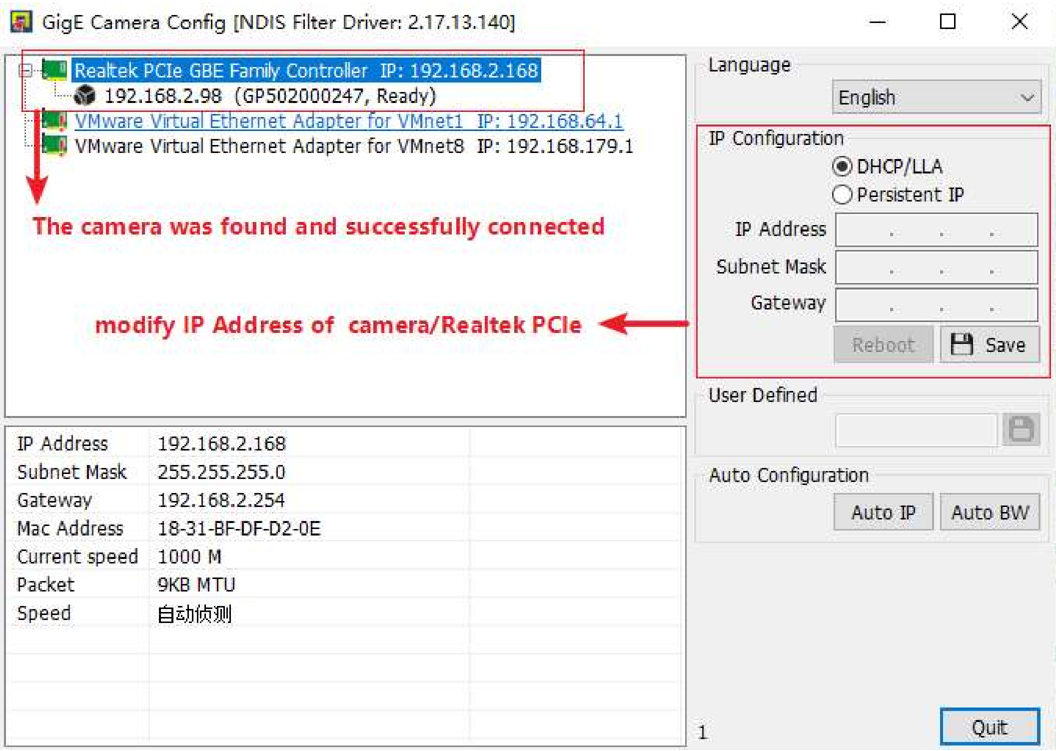

Figure 2.3.1

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.

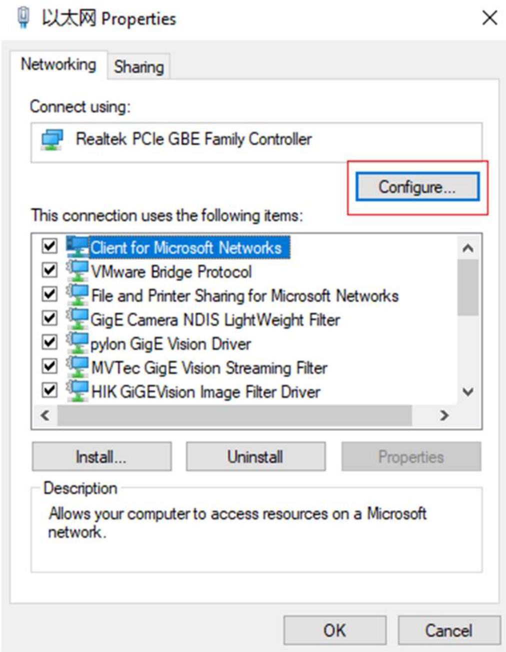

Figure 2.3.2

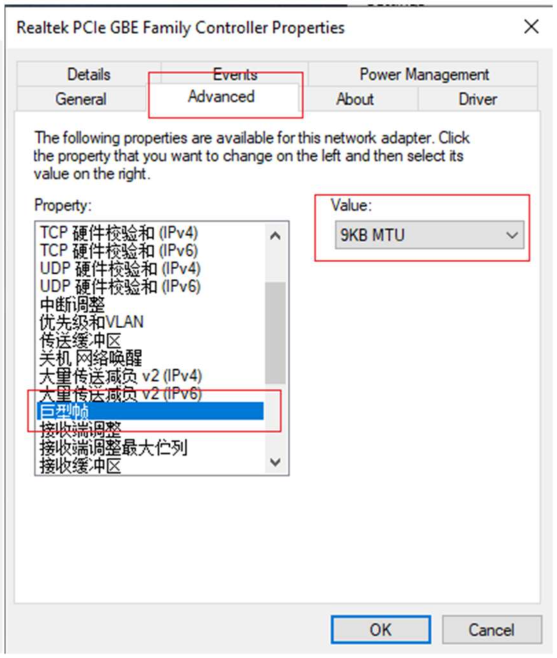

Figure 2.3.3

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.

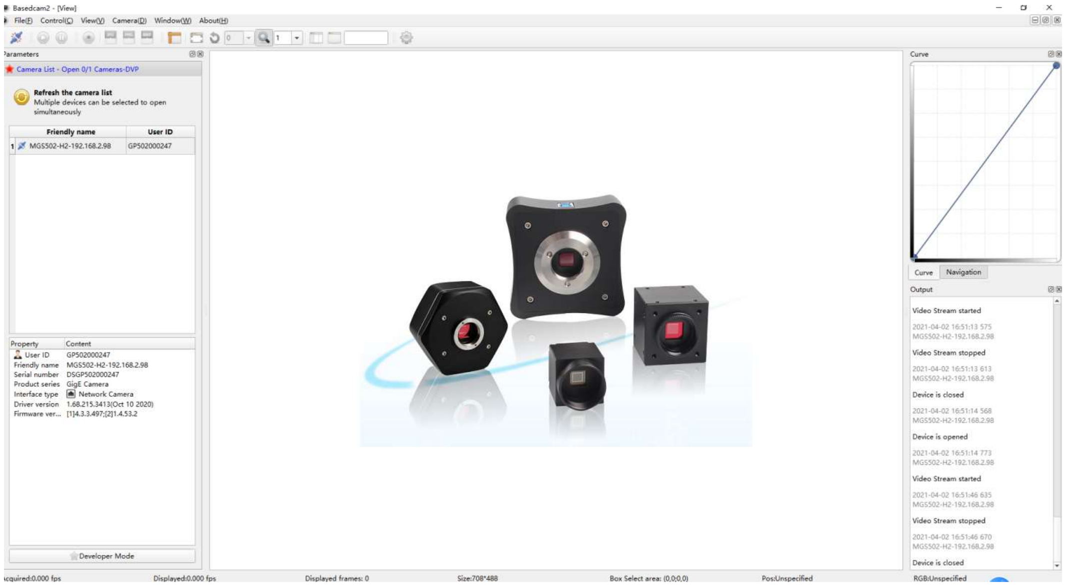

Figure 2.3.4

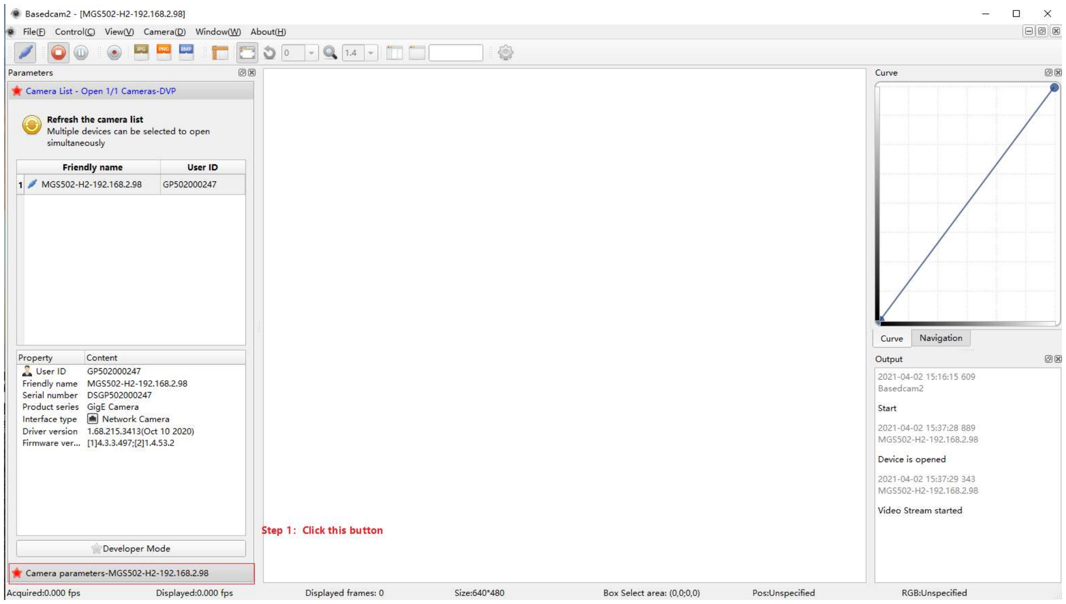

Figure 2.3.5

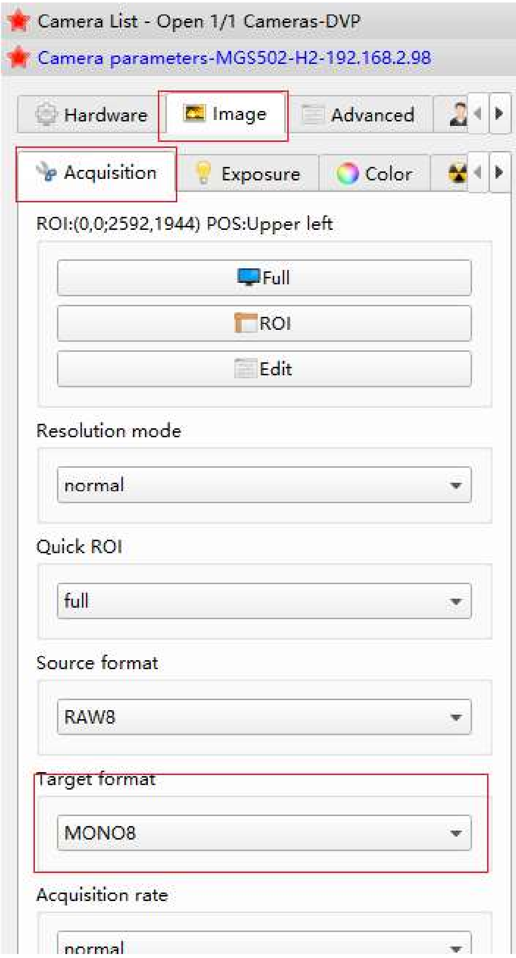

Figure 2.3.6

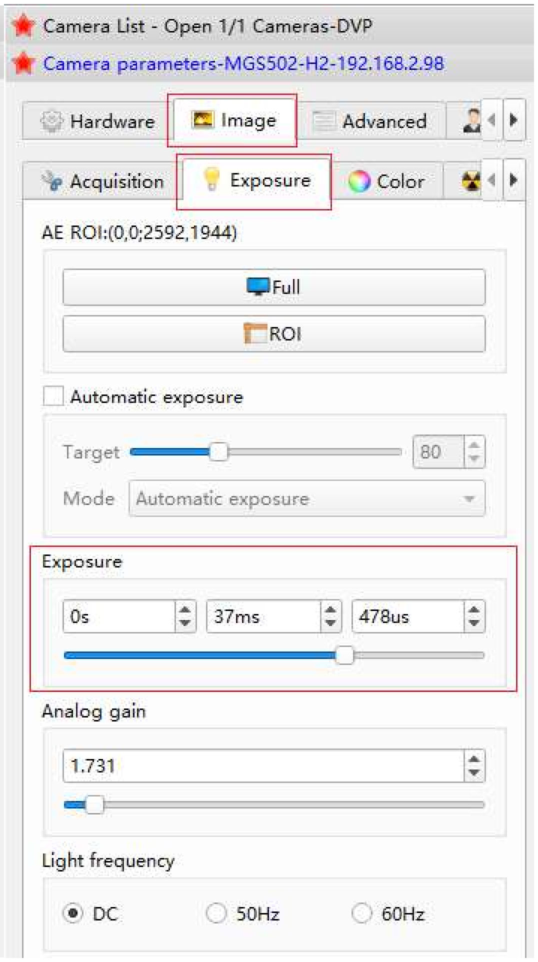

Figure 2.3.7

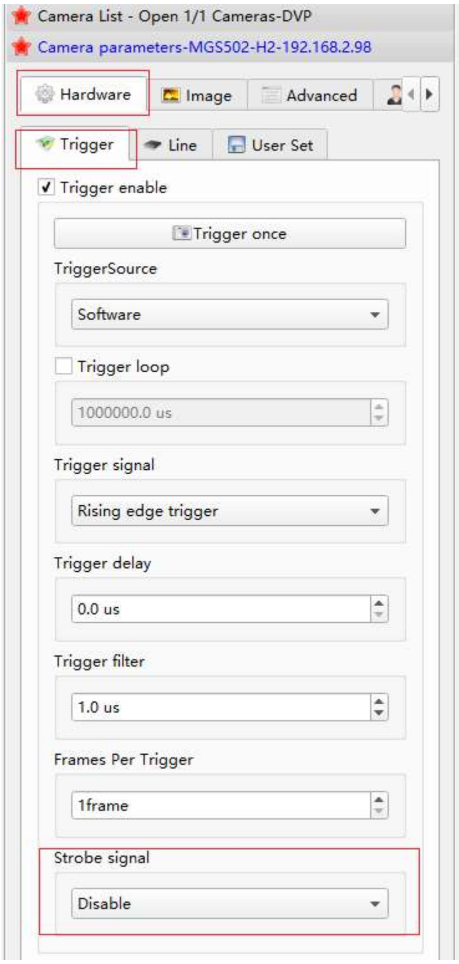

Figure 2.3.8

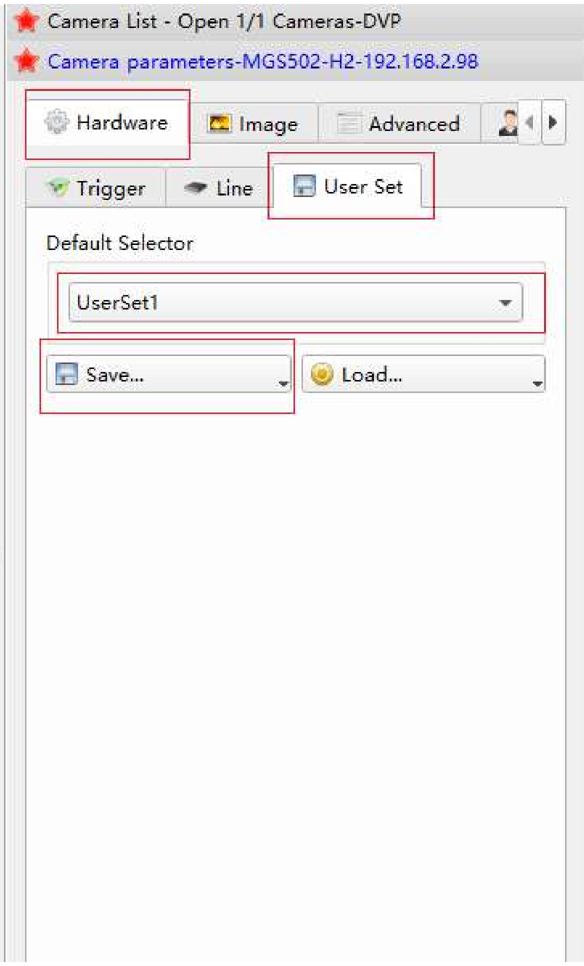

Figure 2.3.9

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.

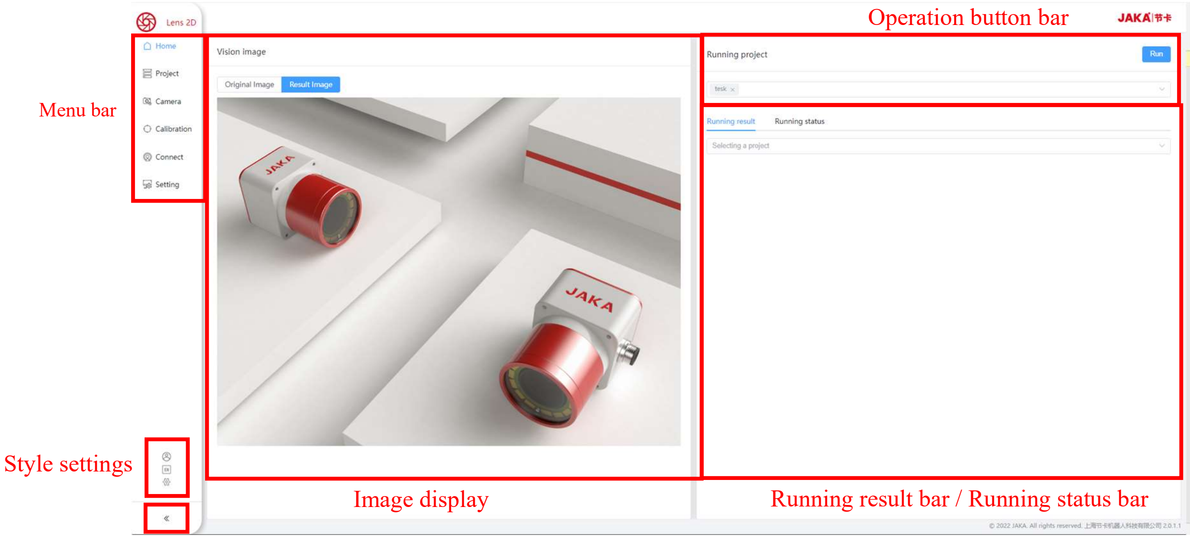

Figure 3.1 Main Interface

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.

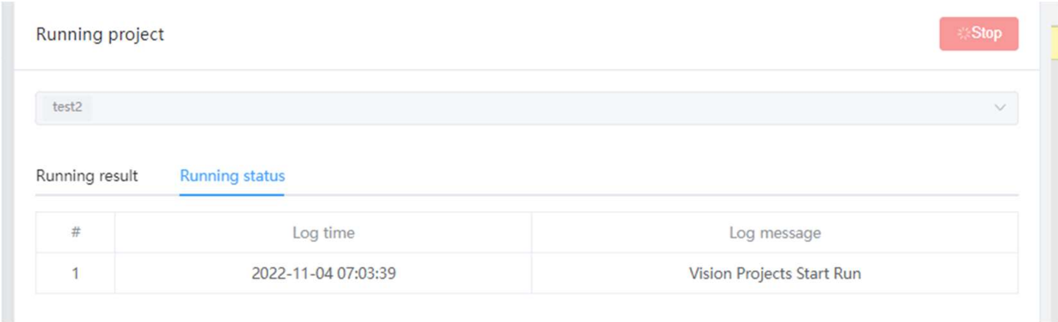

Figure 3.5 Operation Button Bar

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.

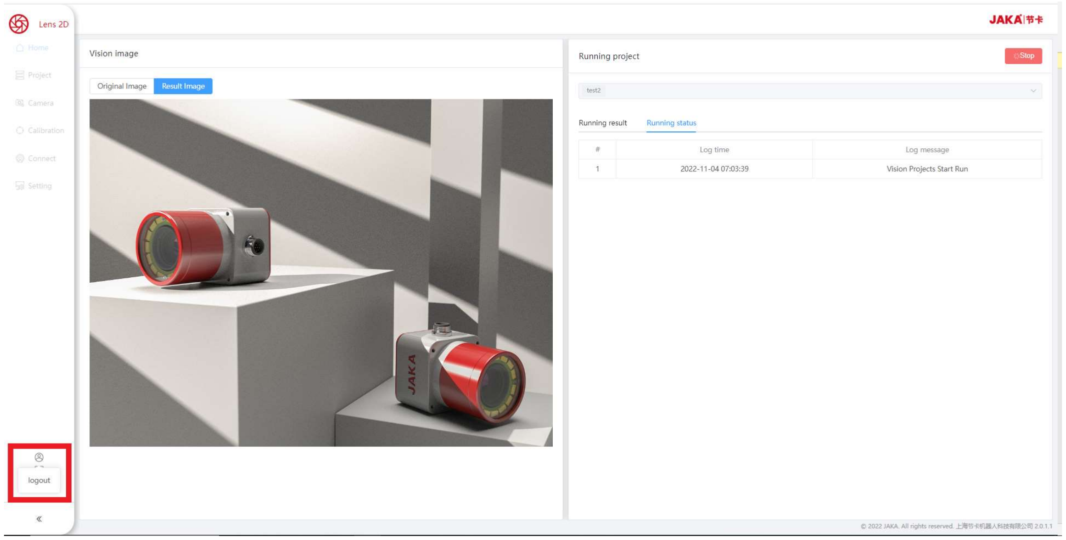

Figure 3.7.1 Operation Button Bar

3.7.2 Language Change

You can change the language of the interface as needed.

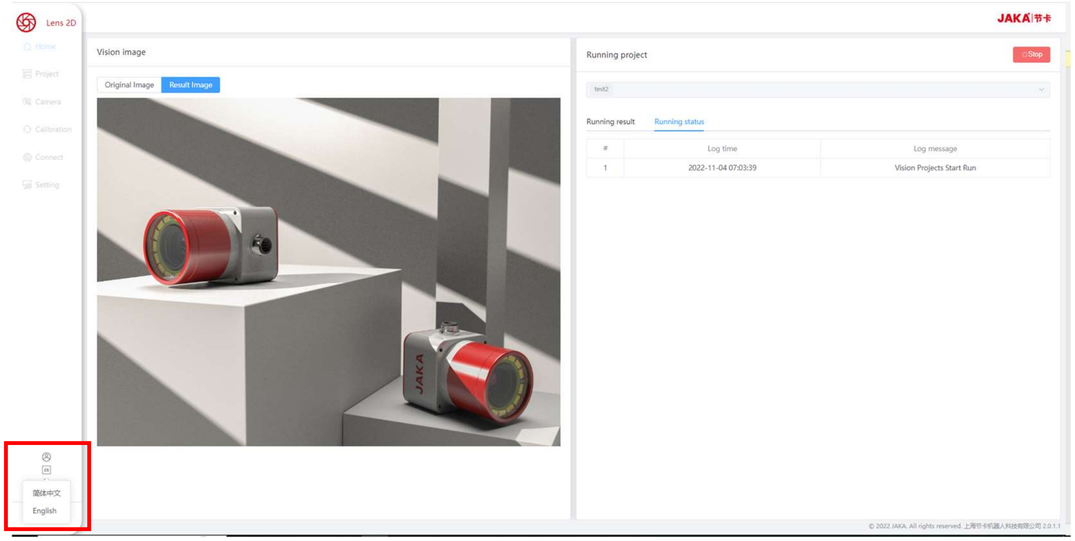

Figure 3.7.2 Language Change

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.

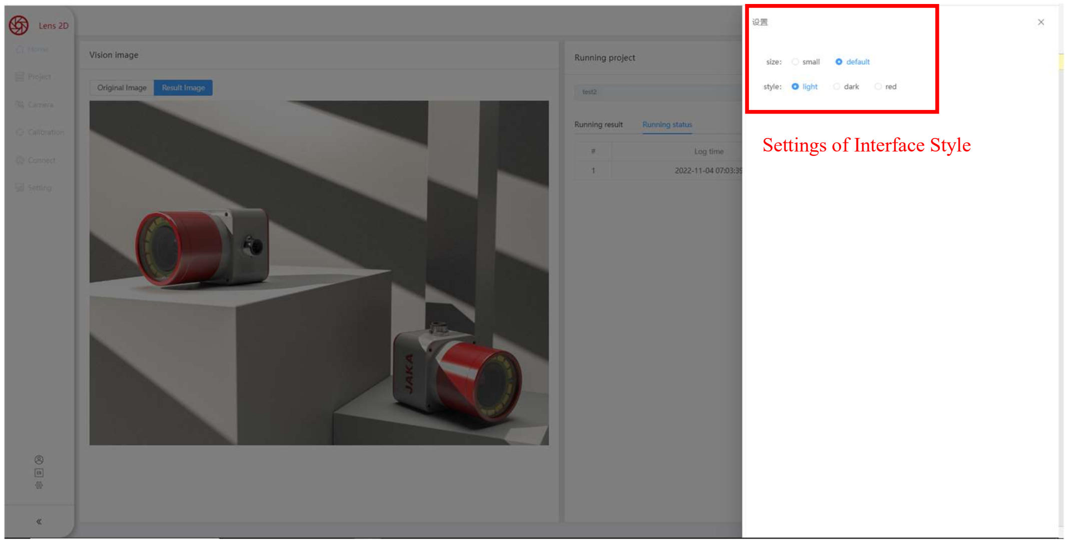

Figure 3.7.3 Settings of Interface Style

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.

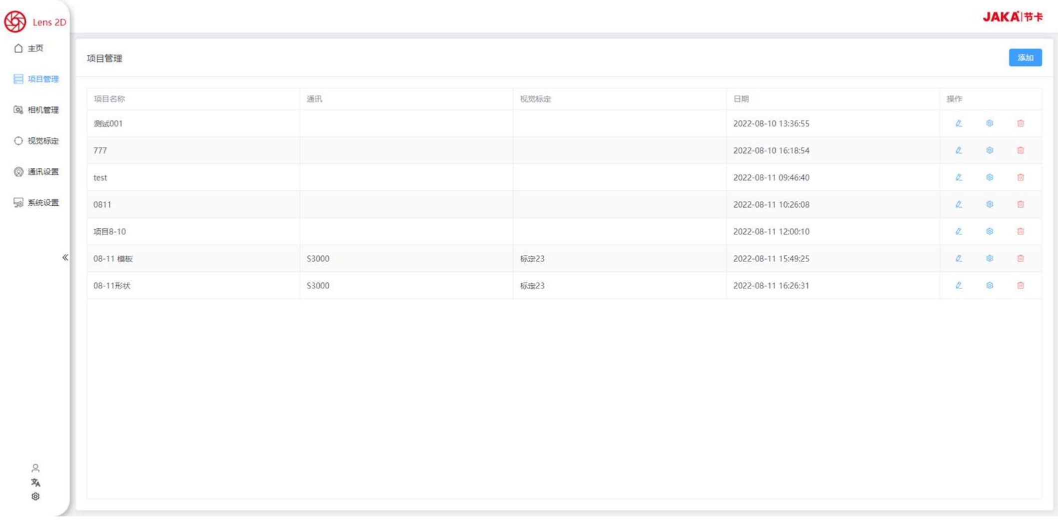

Figure 4.1 Project Management - Project List Interface

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.

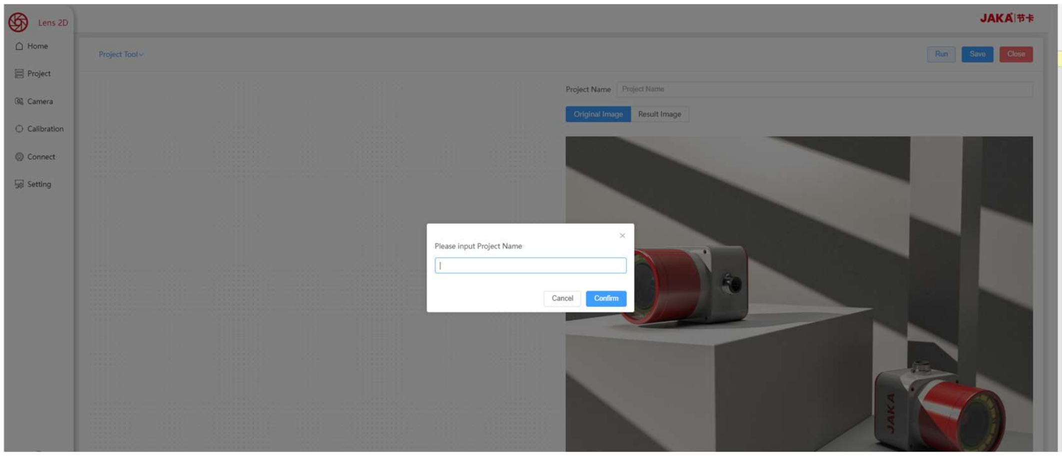

Figure 4.1.1 Interface to Add a New Project

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.

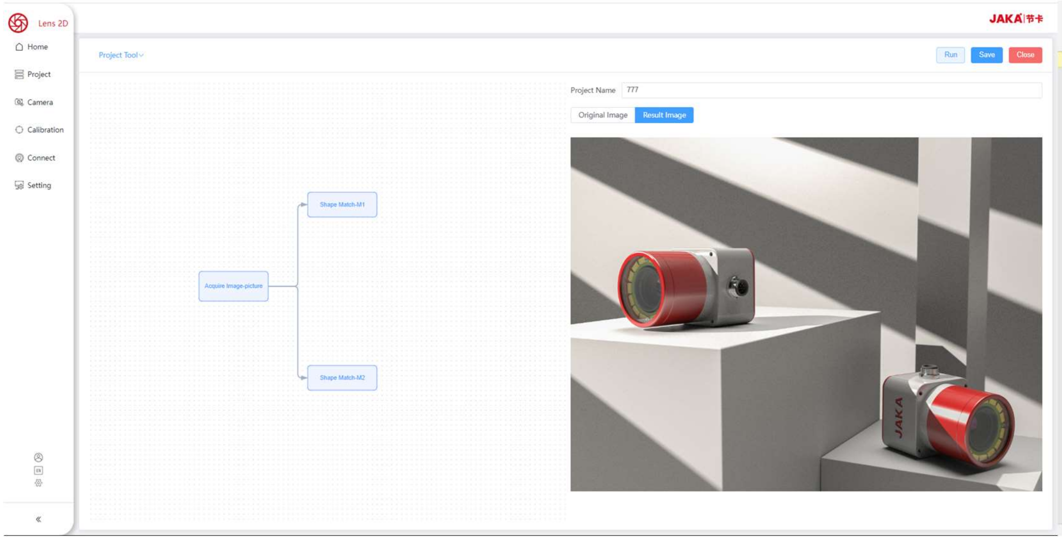

Figure 4.1.2 Interface to Project Editing

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.

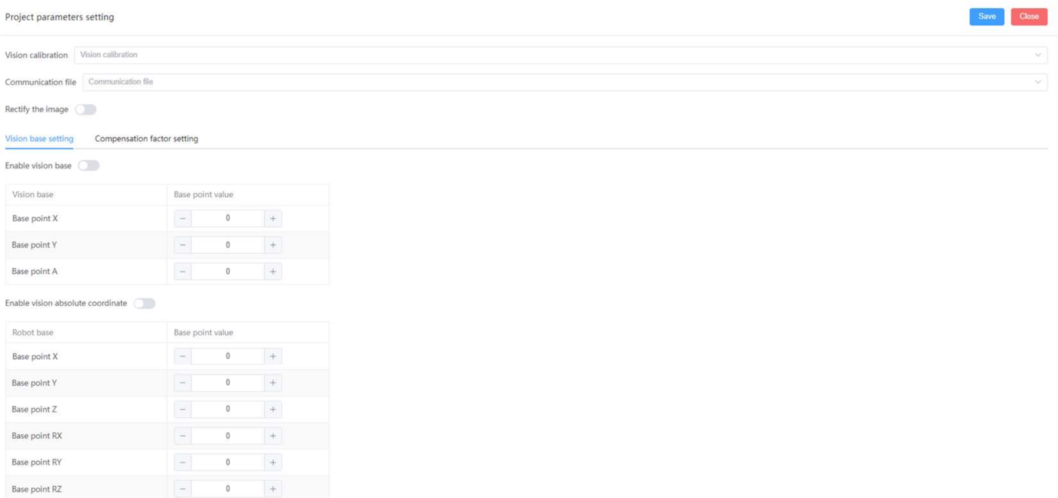

Figure 4.1.3 Interface to Project Settings

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.

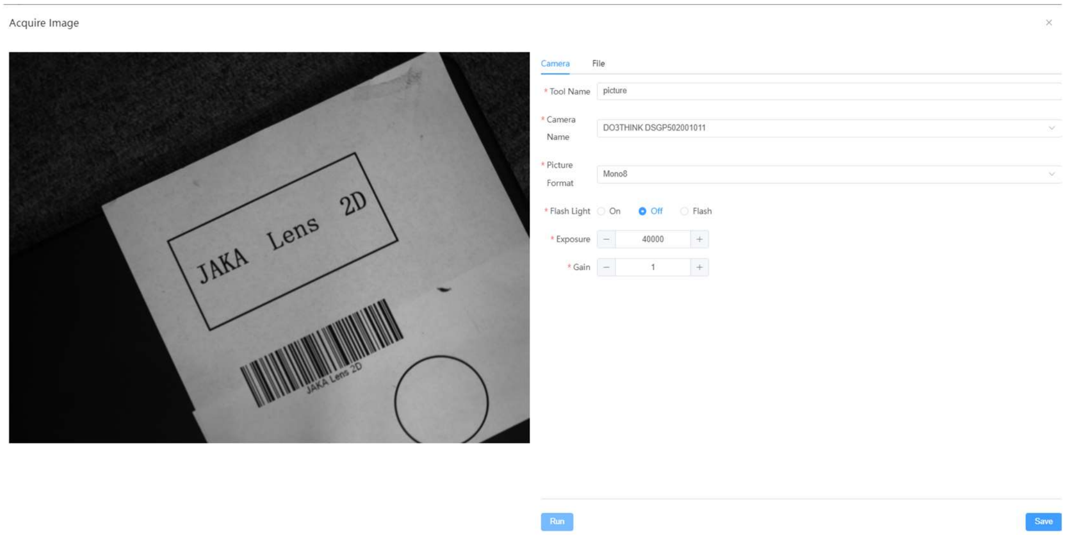

Figure 4.2.1-1 Image Acquisition-camera

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.

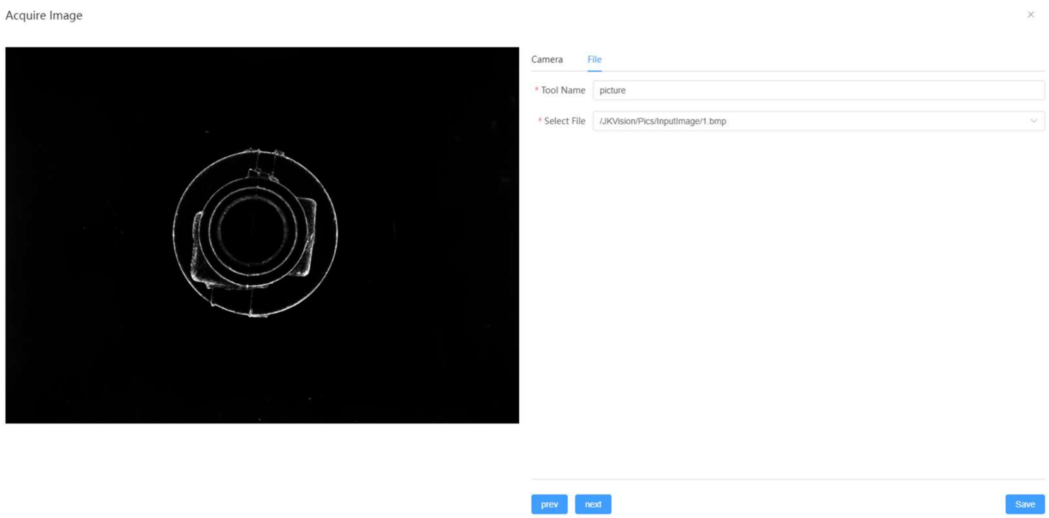

Figure 4.2.1-2 Image Acquisition-file

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.

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.

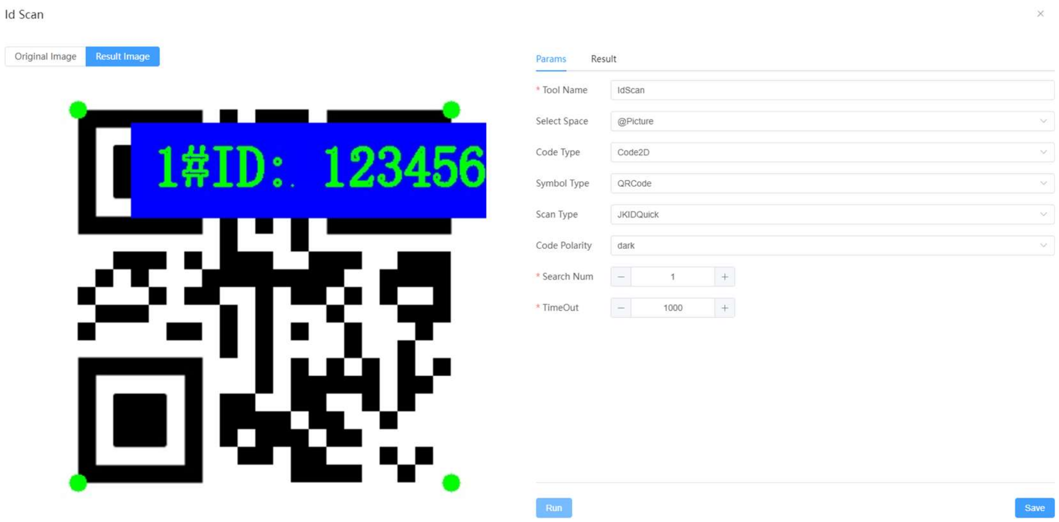

Figure 4.2.3 Identification via Code Scanning

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.

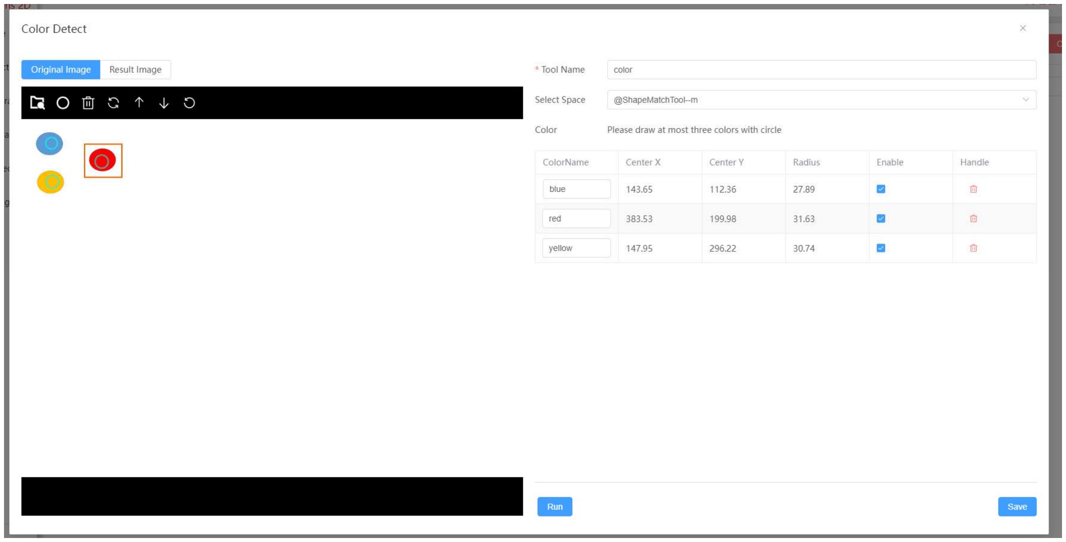

Figure 4.2.4 Color Recognition

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;

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

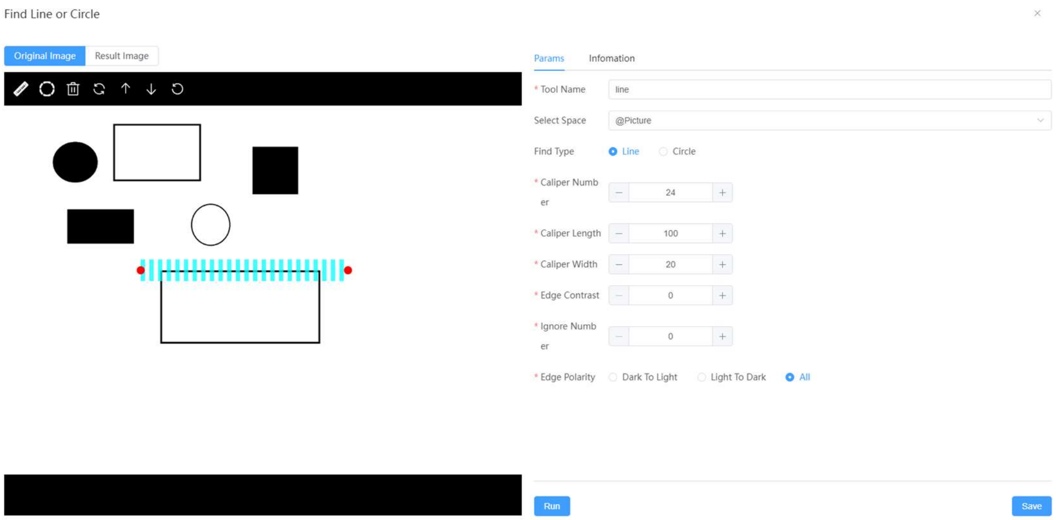

Figure 4.2.5 Edge Identification

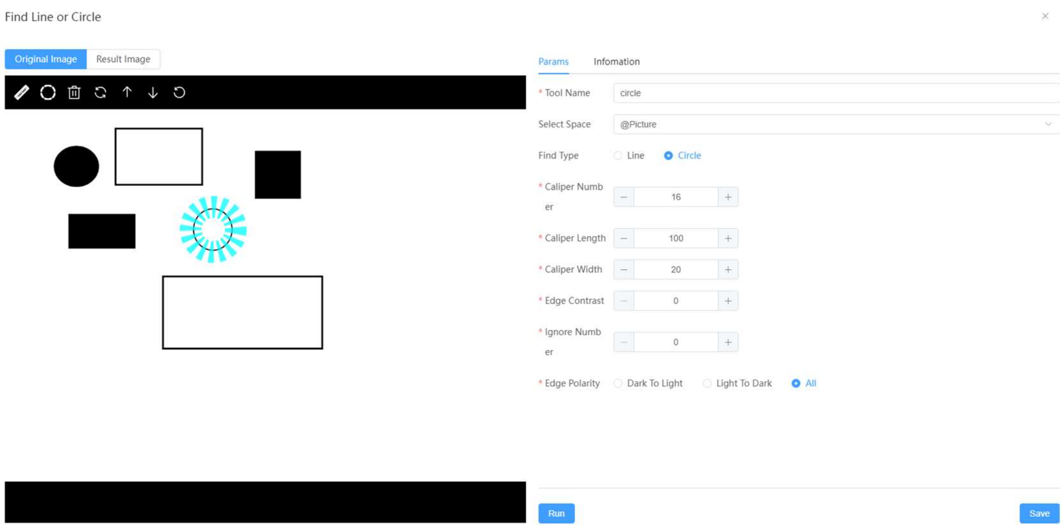

Figure 4.2.6 Circle Identification

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.

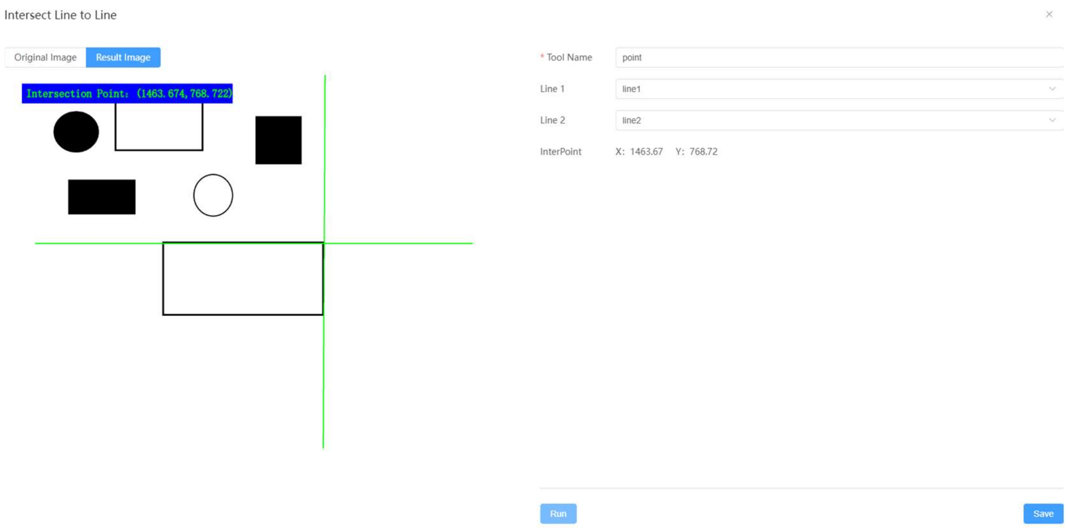

Figure 4.2.7 Line Intersection

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.

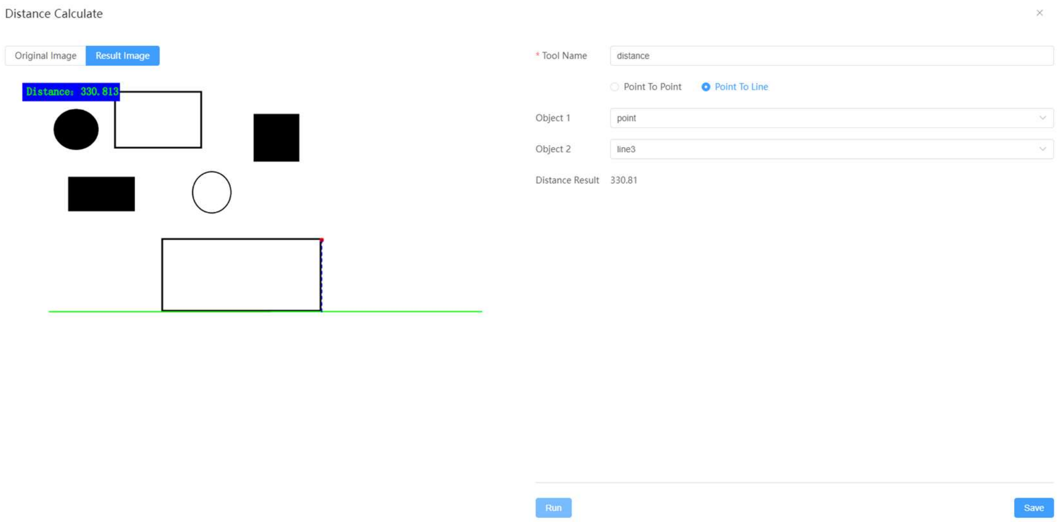

Figure 4.2.8 Distance Calculation

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.

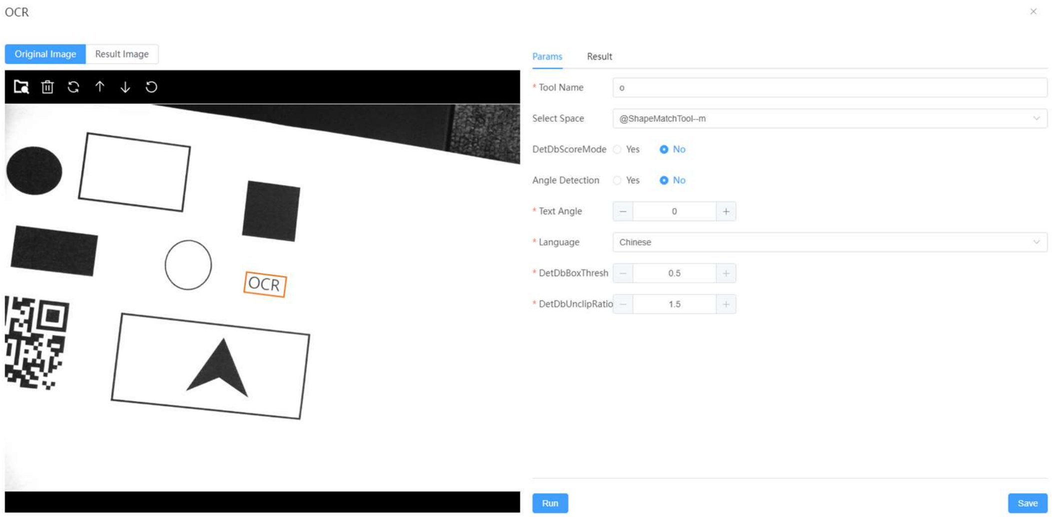

Figure 4.2.9 Character Identification

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).

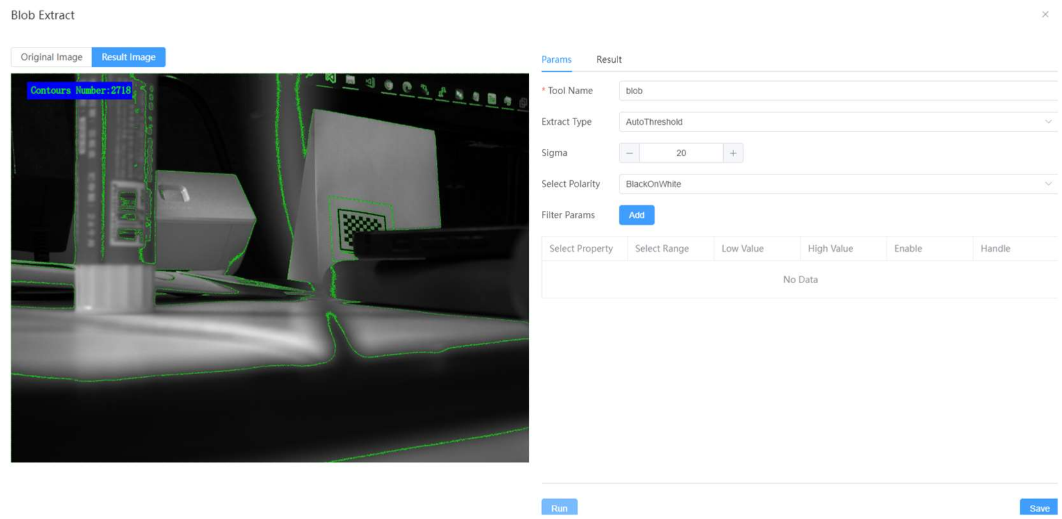

Figure 4.2.10 Automatic Threshold

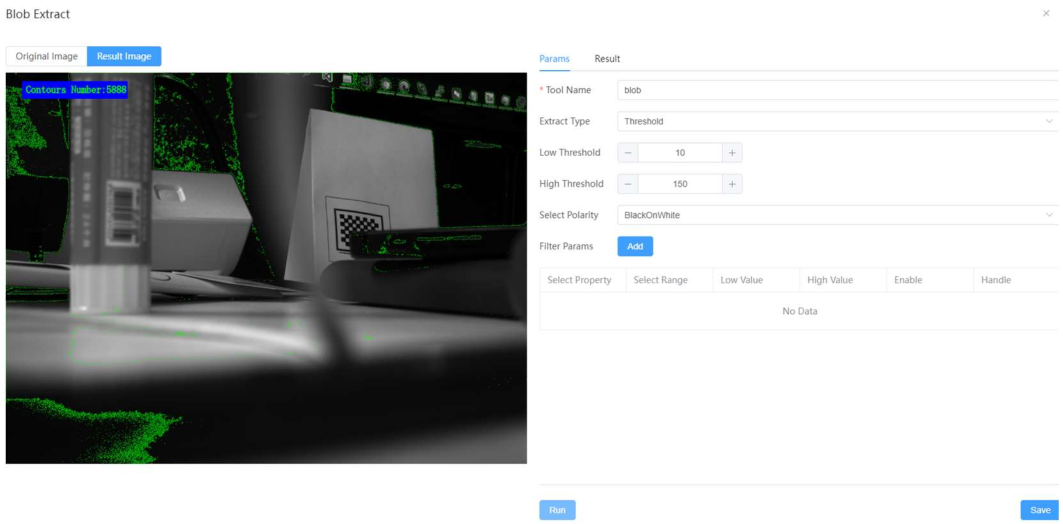

Figure 4.2.11 Hard Threshold

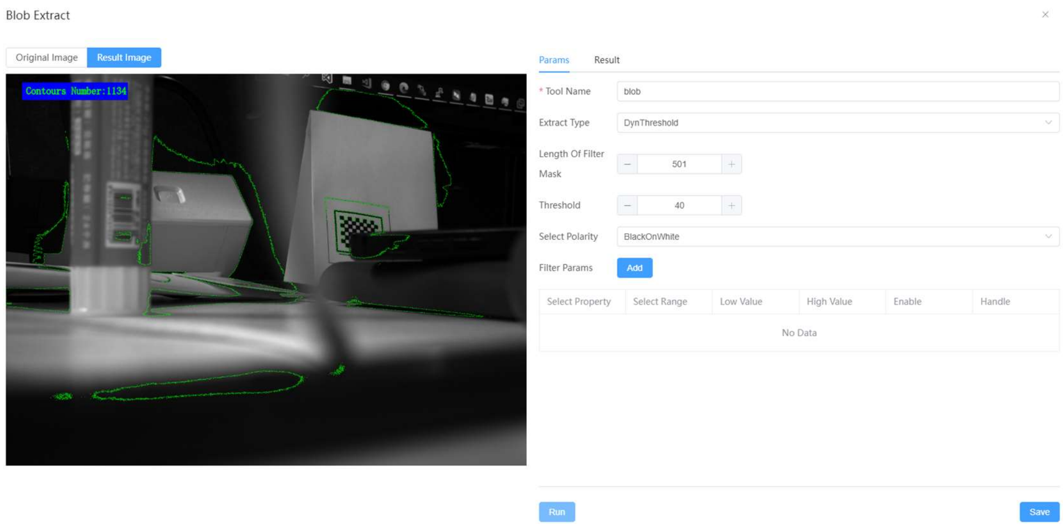

Figure 4.2.12 Dynamic Threshold

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.

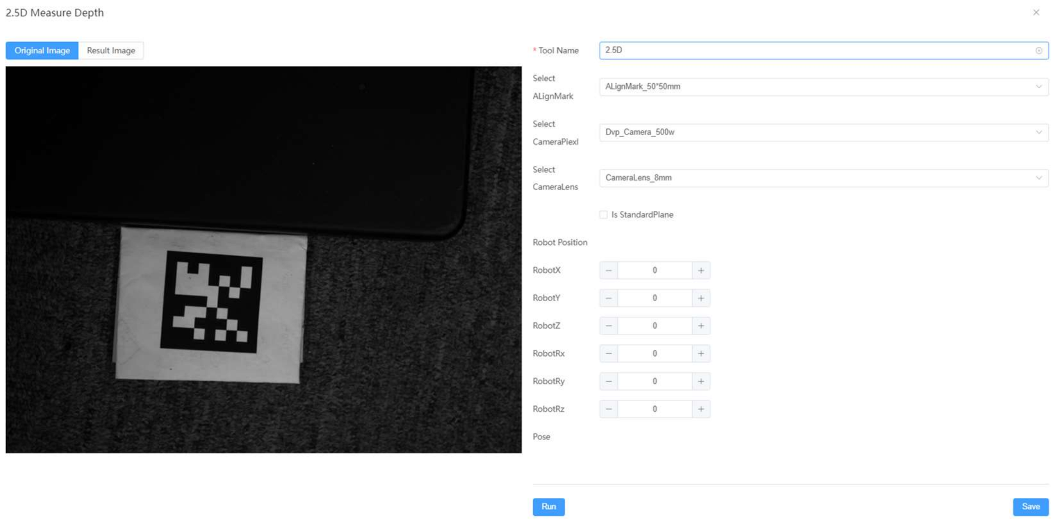

Figure 4.2.13 2.5D Space Ranging

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.

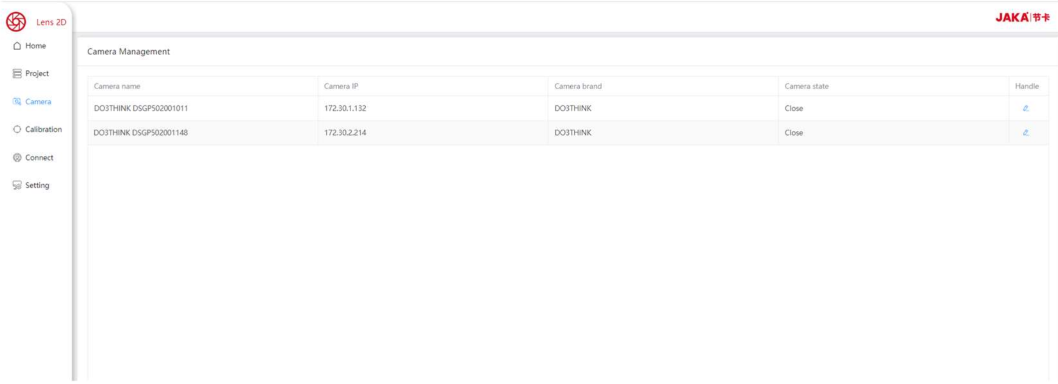

Figure 5.1.1 Camera Management

Click 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.

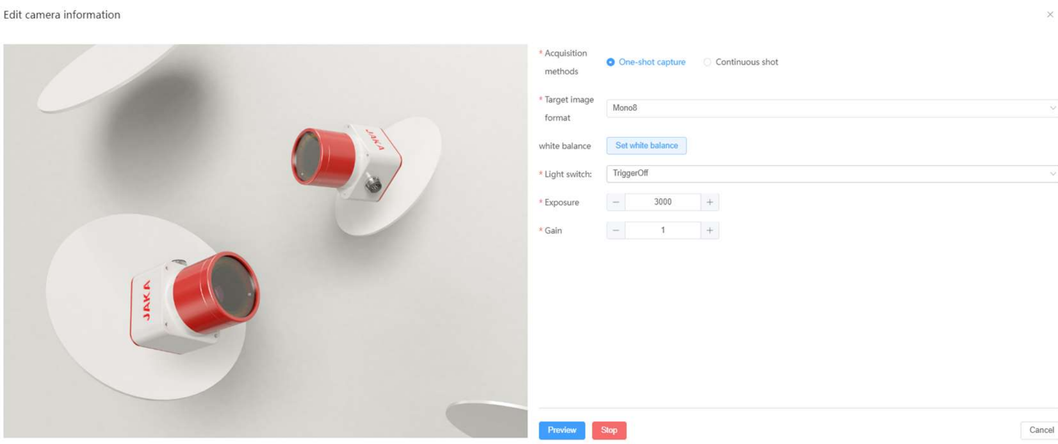

Figure 5.1.2 Camera Configuration

Chapter 6 Visual Calibration

6.1 Visual Calibration Management Interface

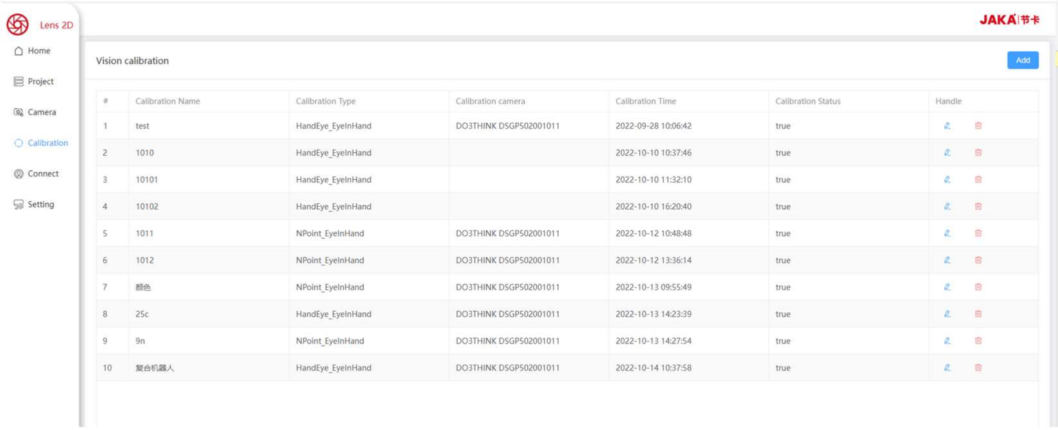

Figure 6.1 Calibration Management Interface

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.

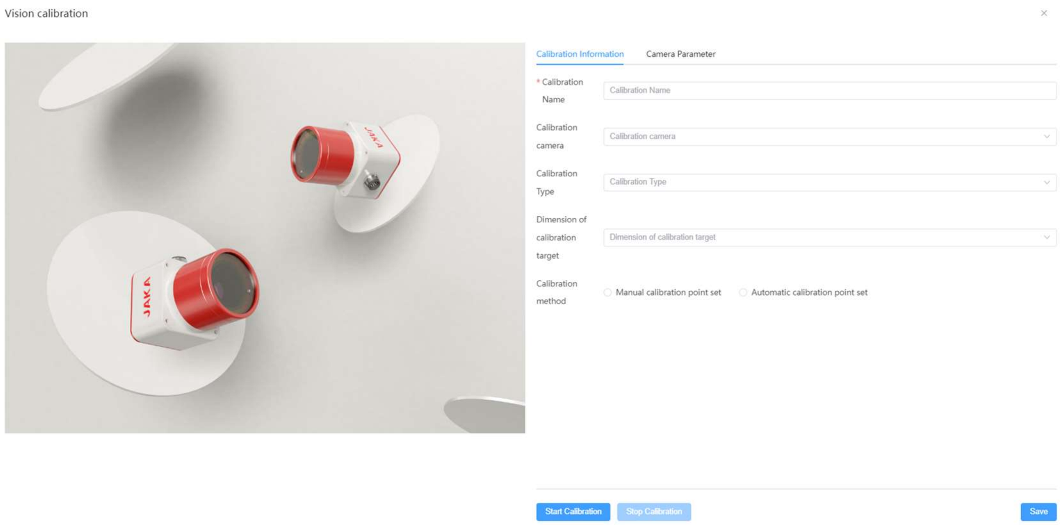

Figure 6.1.1-1 Calibration Parameter Configuration Interface

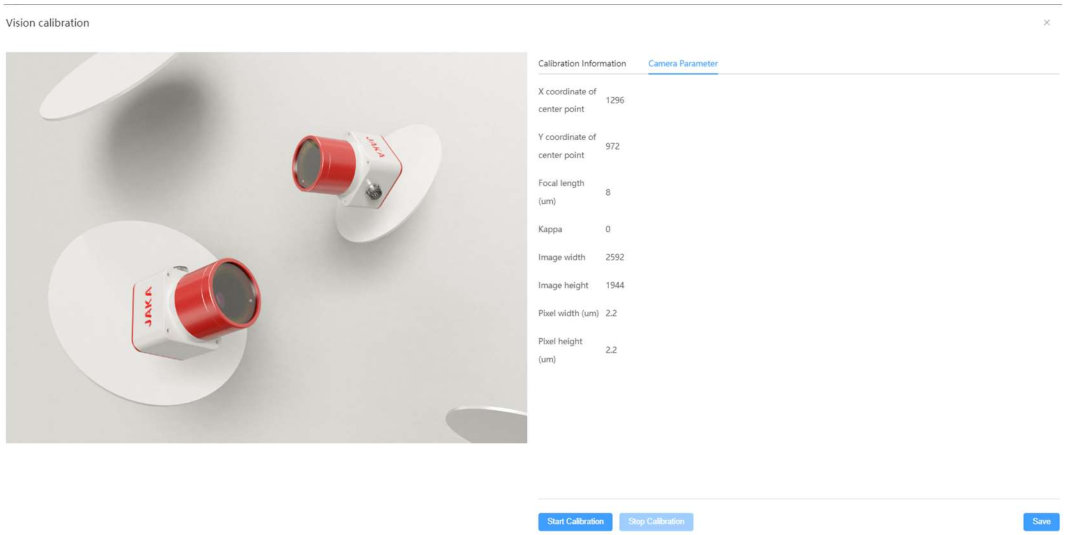

Figure 6.1.1-2 Calibration Parameter Configuration Interface

See Table 6.1 for the definition of each parameter:

Table 6.1

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-in-hand 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 used in calibration;	The size of the calibration board is the edge length of the black square on it
Calibration Method		**Manual Demonstration Calibration Point** refers to demonstrating the position of each calibration point to the robot in advance; **Automatic Planning Calibration Point** refers to demonstrating the initial point to the robot and put the calibration board at the center of the camera view.	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 which Home Point is the capturing point. The calibration board is at the center of the camera view when in the Home Point; When choosing Automatic Planning Calibration Point, you need to input robot the IP address and 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;
Server port number		The robot port number needs to be consistent with this port number	/
Robot IP address		IP address of the robot	/
Movement step coefficient		Used in Automatic Planning Calibration Point, indicating the step of the robot's every movement in calibration	The default value is 1, and it can be adjusted according to the actual situation. If the calibration board is outside the view during movement, the coefficient can be gradually reduced (by 0.1 each time) until the calibration board is fully visible in different positions of the view.
Camera parameter list	Pixel width	2.2um by default	This can be looked up using the camera model number
	Pixel height	2.2um by default	This can be looked up using the camera model number
	Focal length	8mm by default	Input the focal length of the lens you have chosen
	Kappa	Camera distortion, which is 0 by default	The distortion value is generally 0. Input the value from the supplier

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

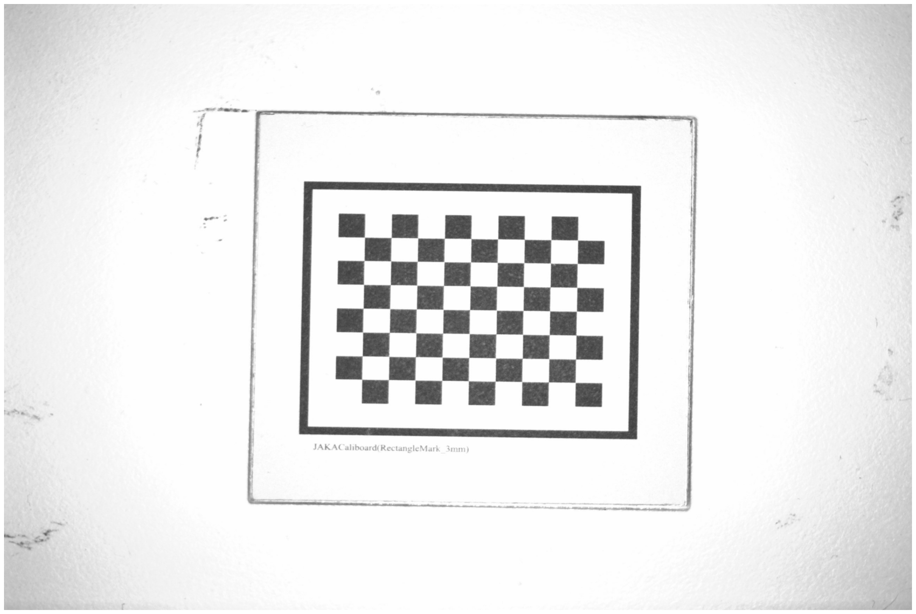

Figure 6.1.2 The calibration board is in the center of the camera view

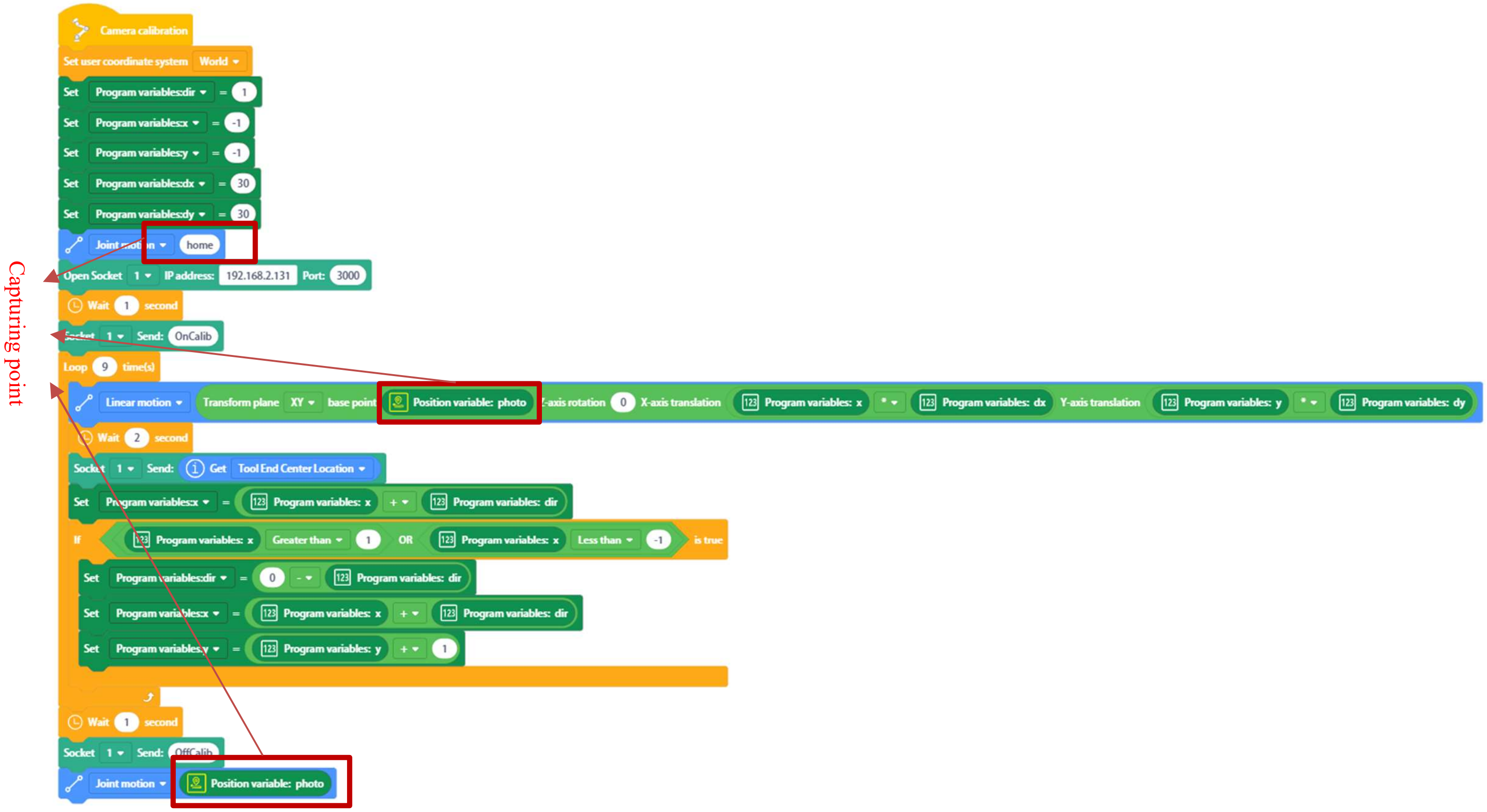

Figure 6.1.3 Manual Calibration Program

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.

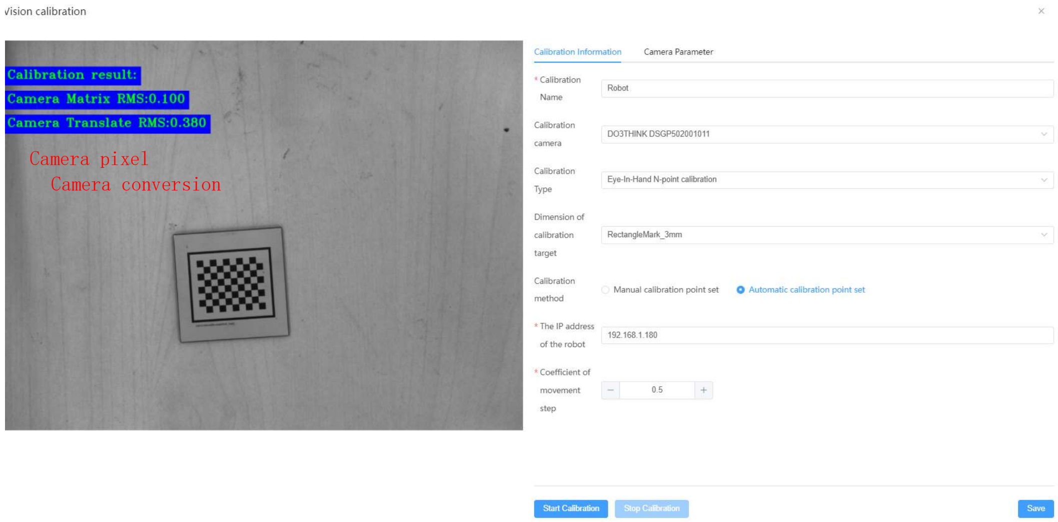

Figure 6.1.4 Calibration Result

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.

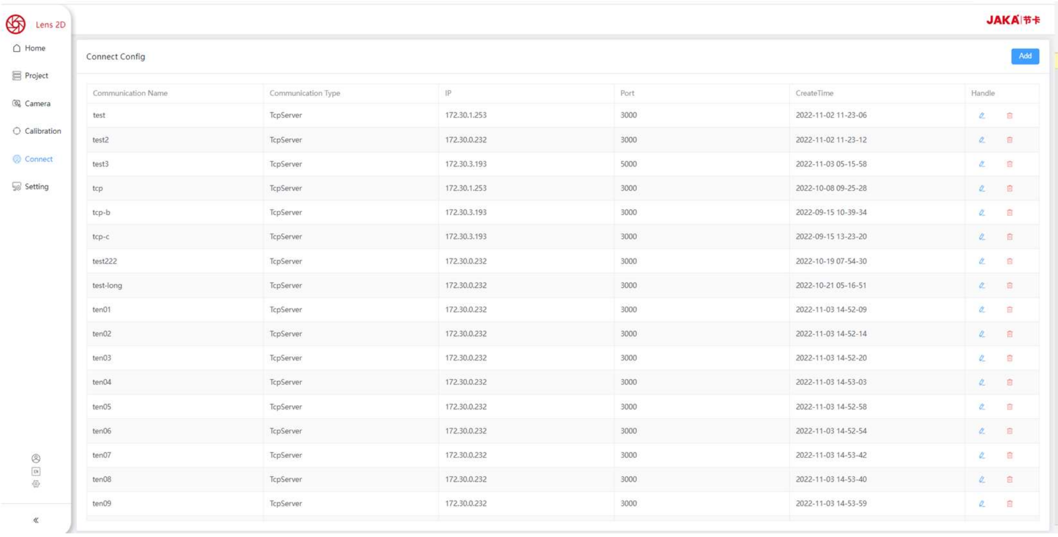

Figure 7.1 Communication file adding

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

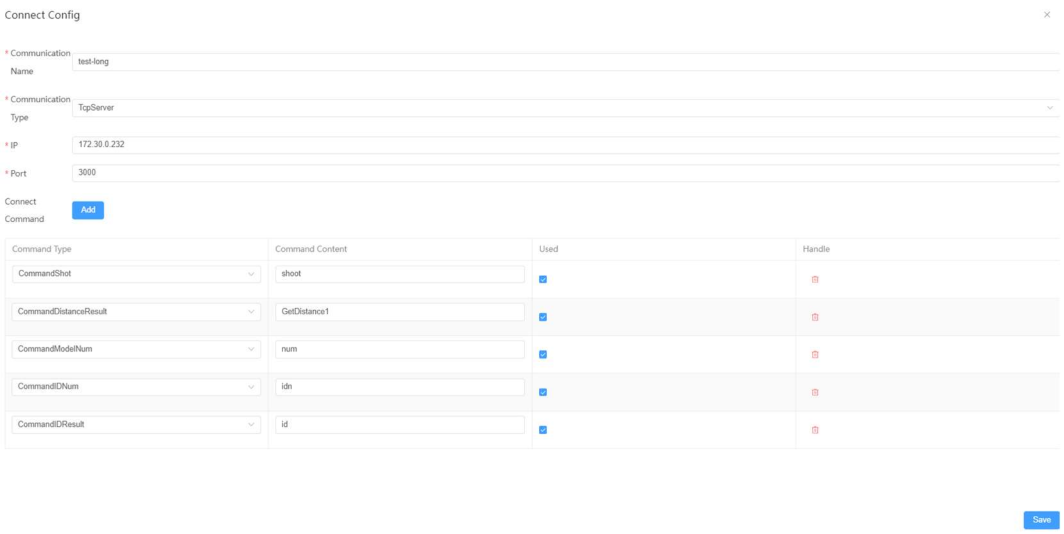

Figure 7.2 Communication file editing

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.

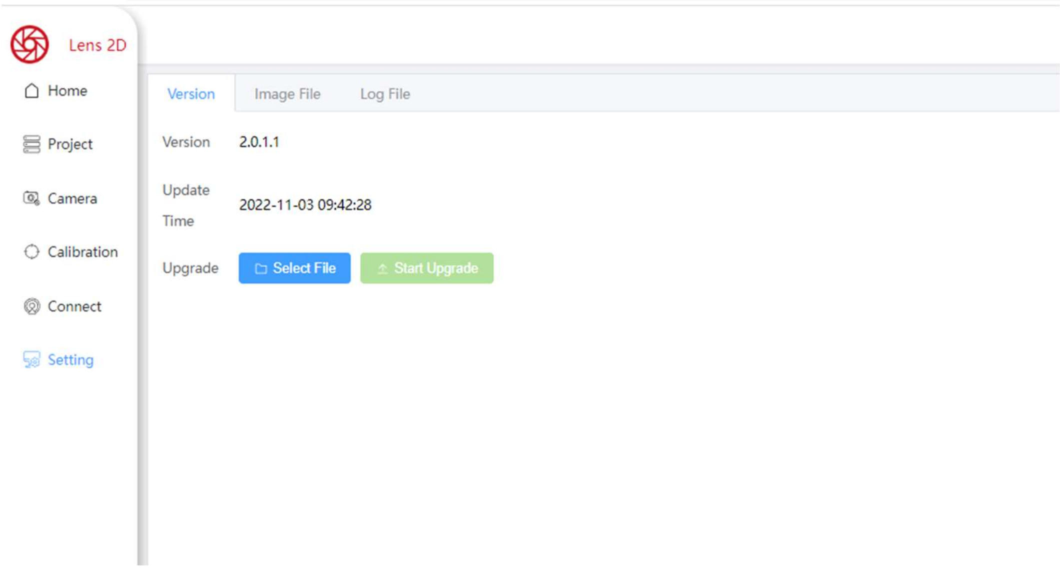

Figure 8.1-1 Software version

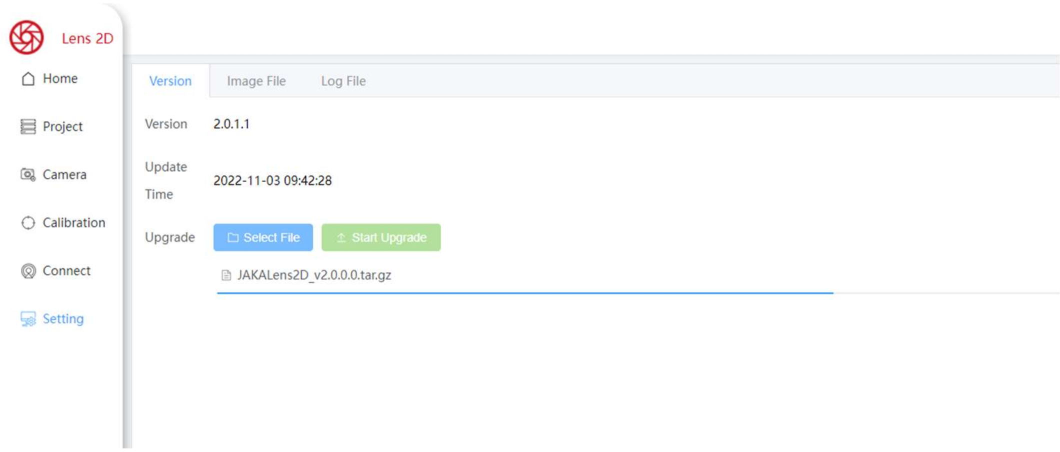

Figure 8.1-2 Software upgrade

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.

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

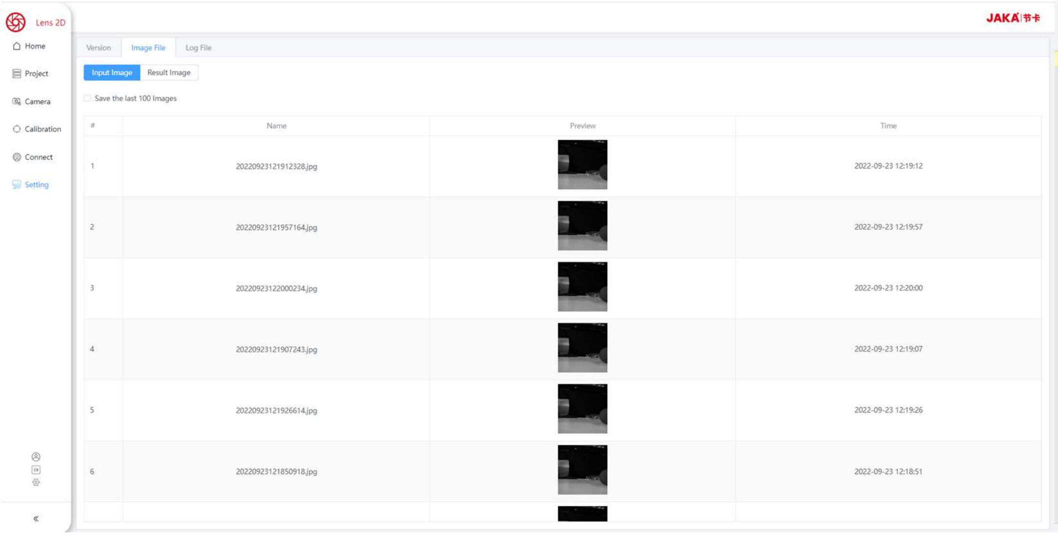

Figure 8.2 Image file

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.

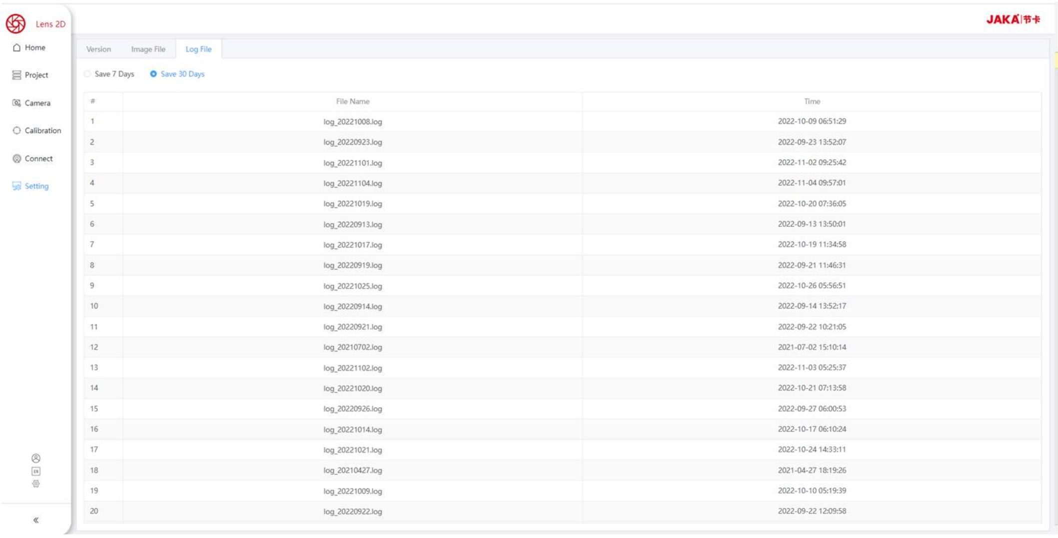

Figure 8.4 Log file

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:

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.

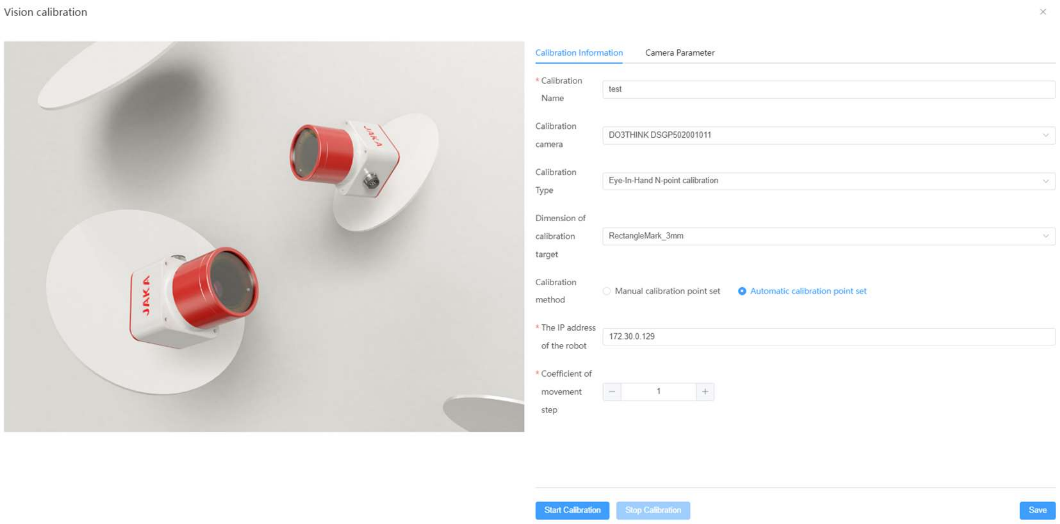

Figure 9.1.1 Visual Calibration

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.

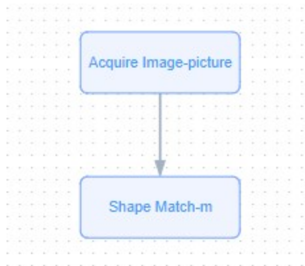

Figure 9.1.2 Visual Flowchart

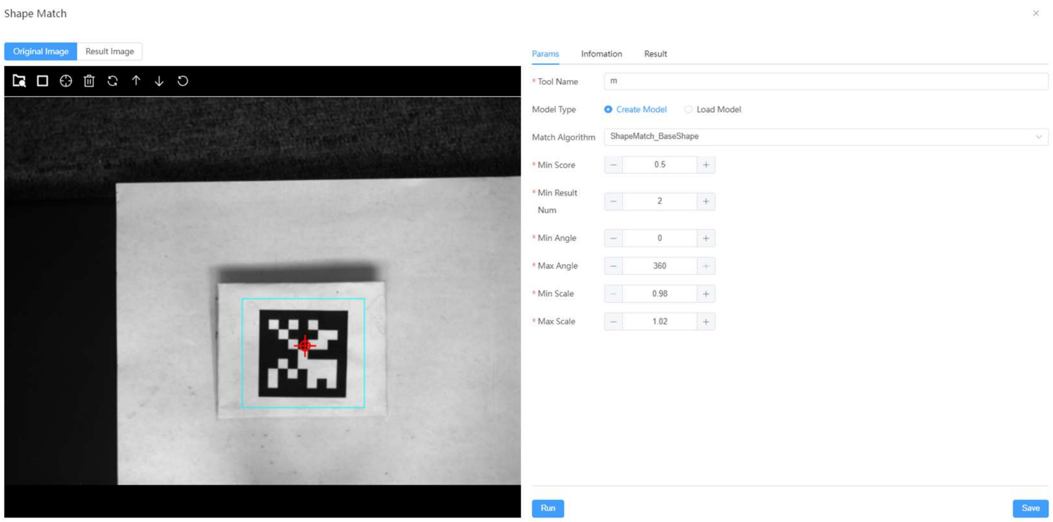

Figure 9.1.3 Template Matching

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.

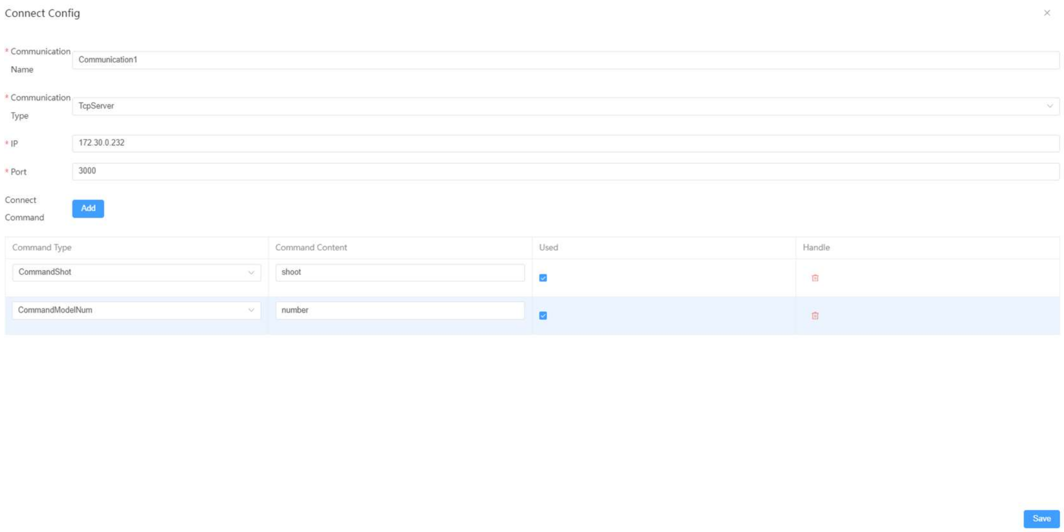

Figure 9.1.4 Communication Settings

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:

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.

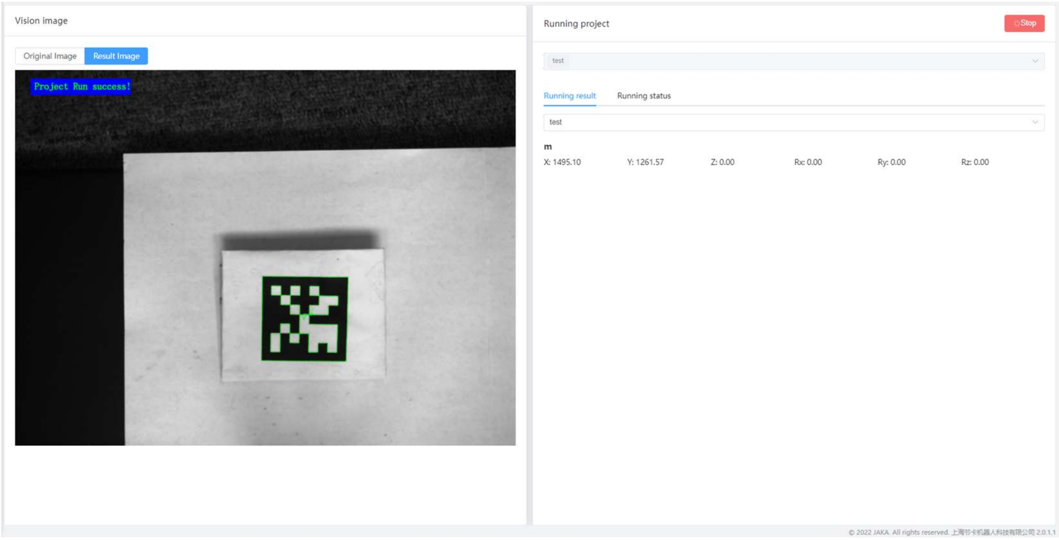

Figure 9.1.5 Project Running Homepage

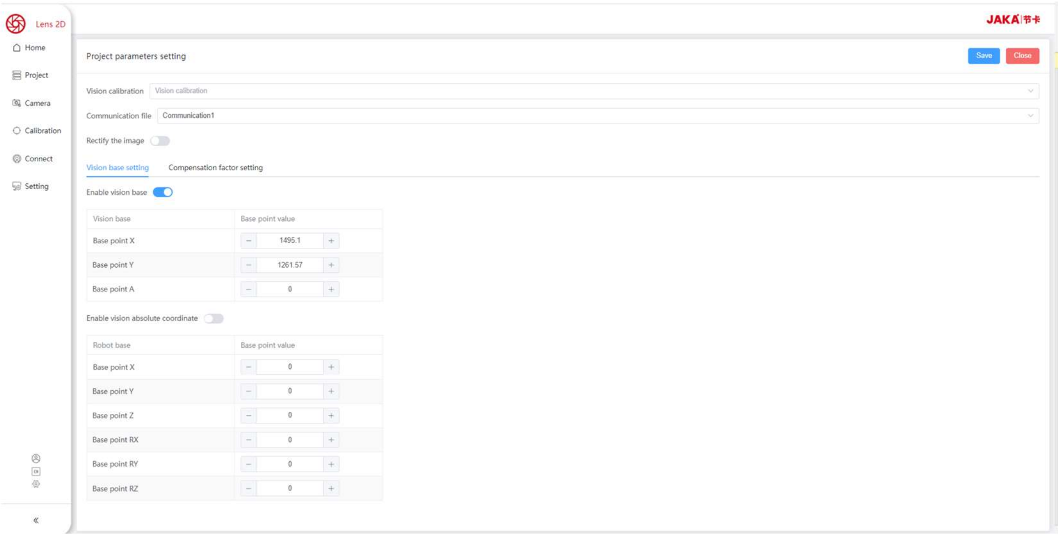

Figure 9.1.6 Interface to Set a Project

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

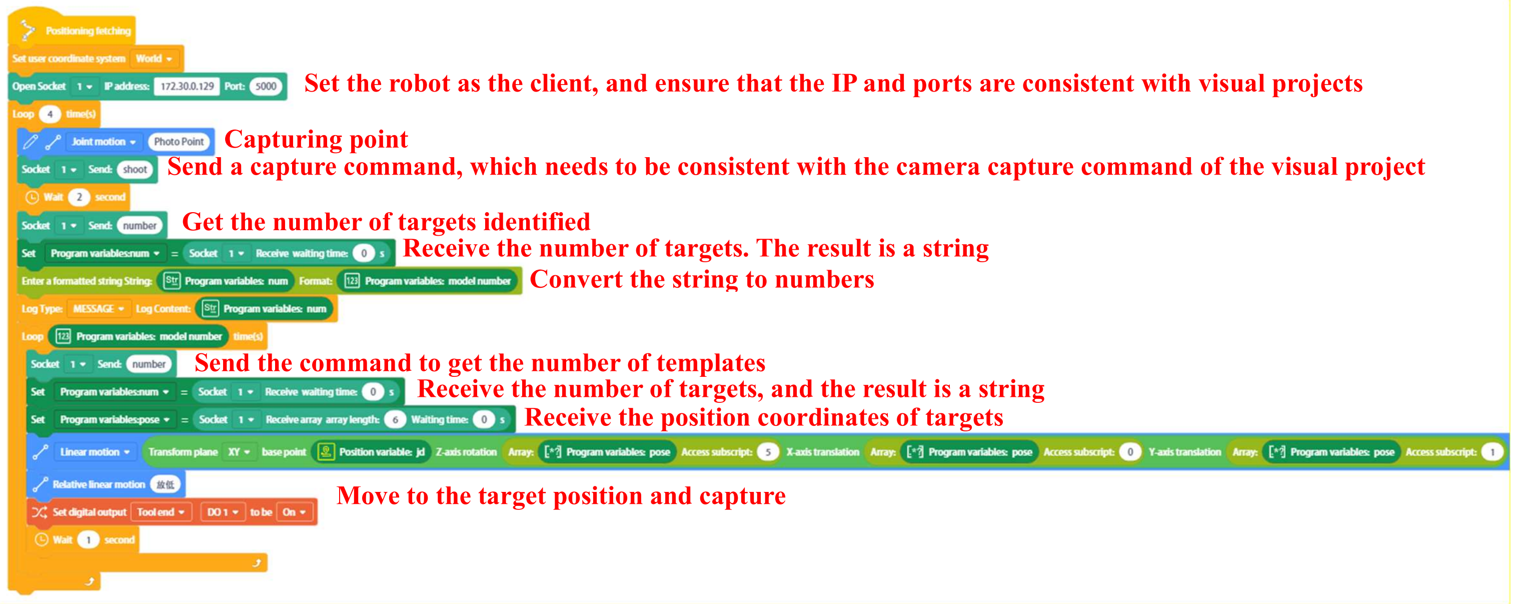

Figure 9.1.7 Robot program - N-point calibration

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”:

Figure 9.1.8 Robot program - Hand-eye calibration

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

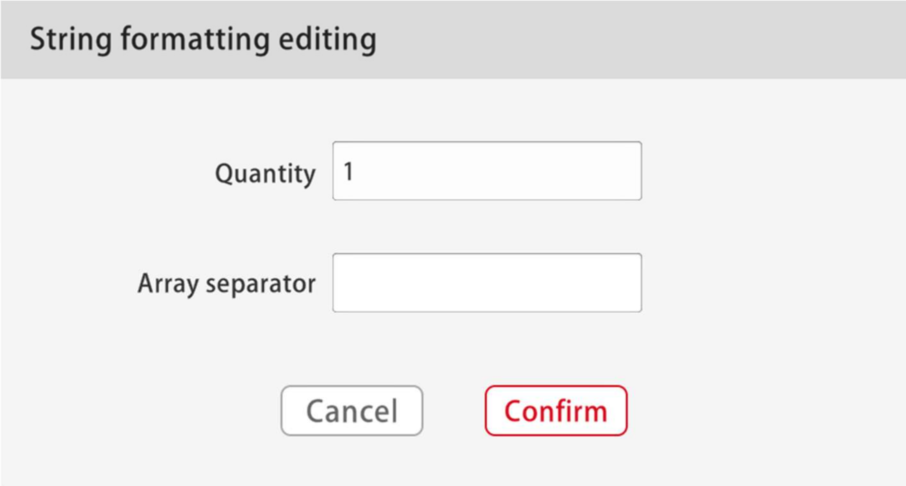

Figure 9.1.9 Enter the formatted string settings

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.

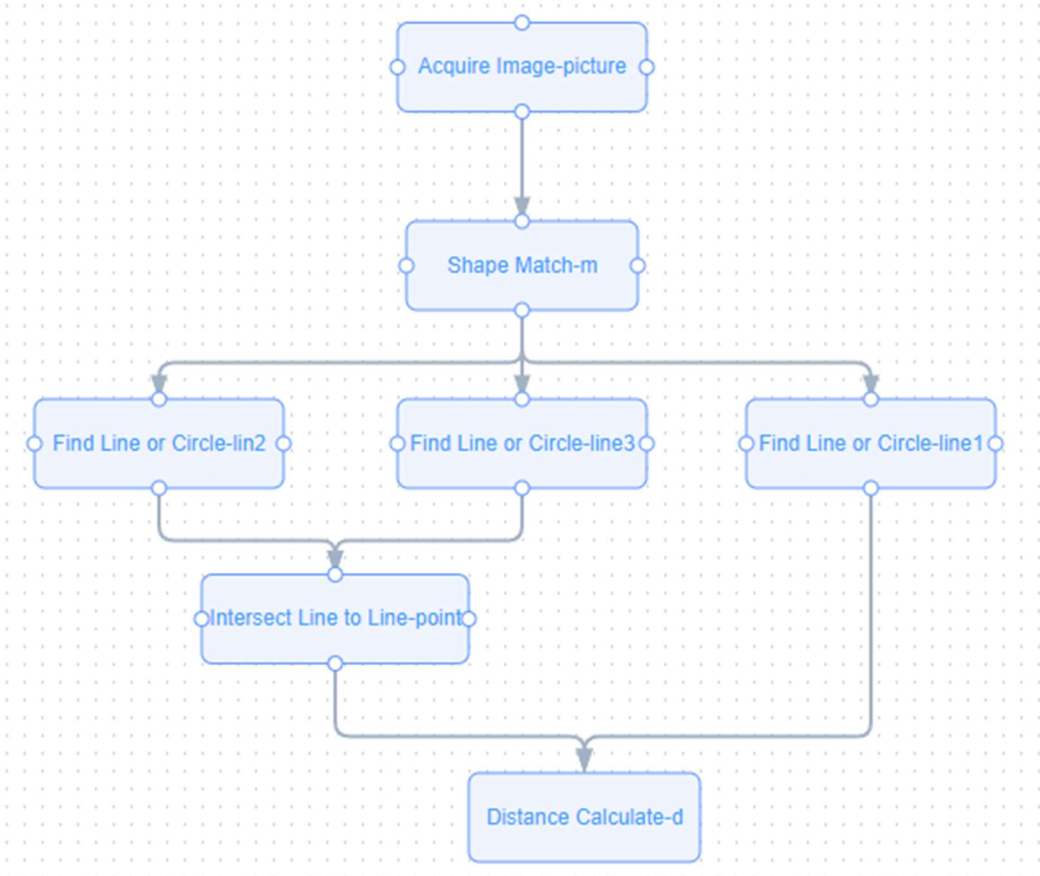

Figure 9.2.1 Visual Flowchart

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);

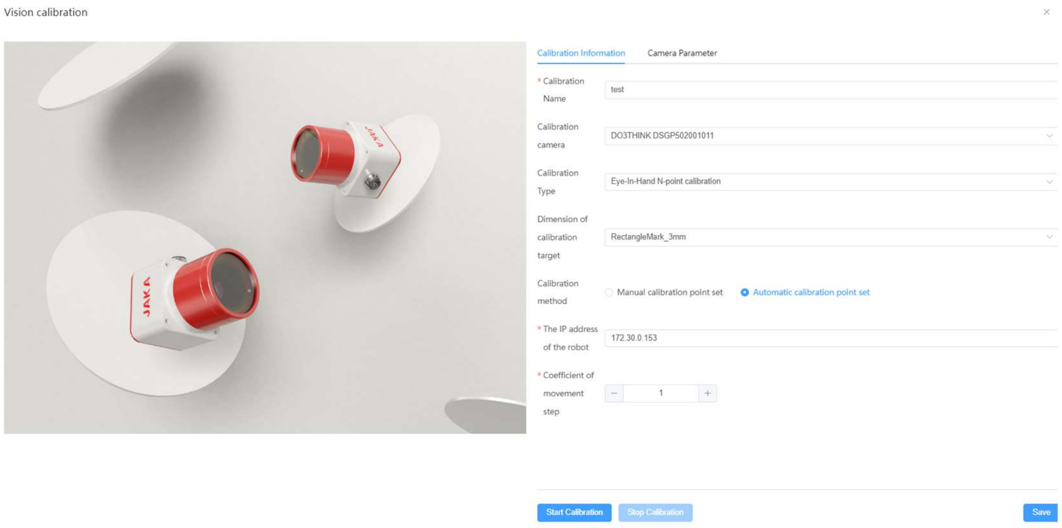

Figure 9.2.2 Visual Calibration

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:

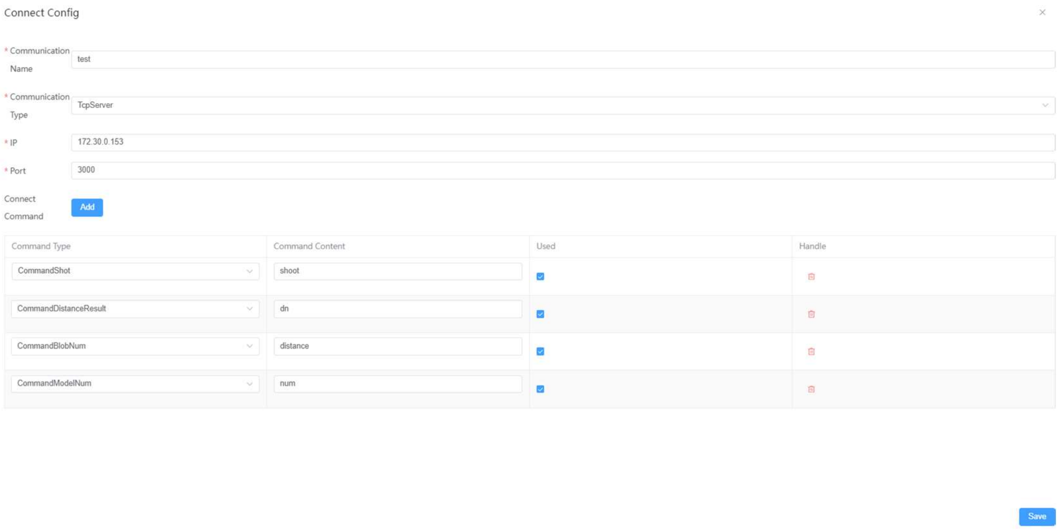

Figure 9.2.3 Communication Settings

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:

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.

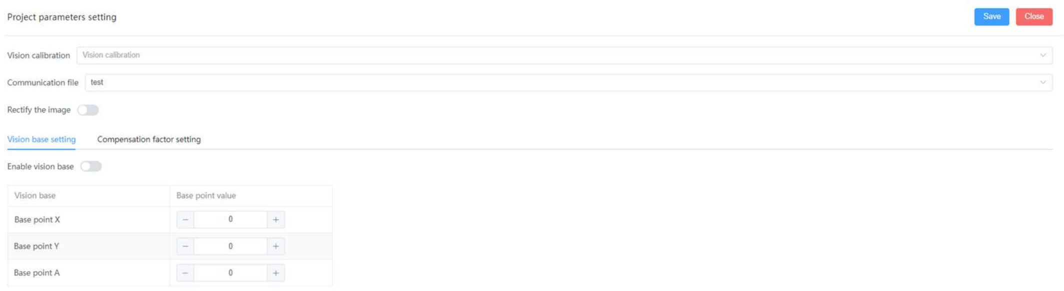

Figure 9.2.4 Interface to Set a Project

Step 5: Write a robot program.

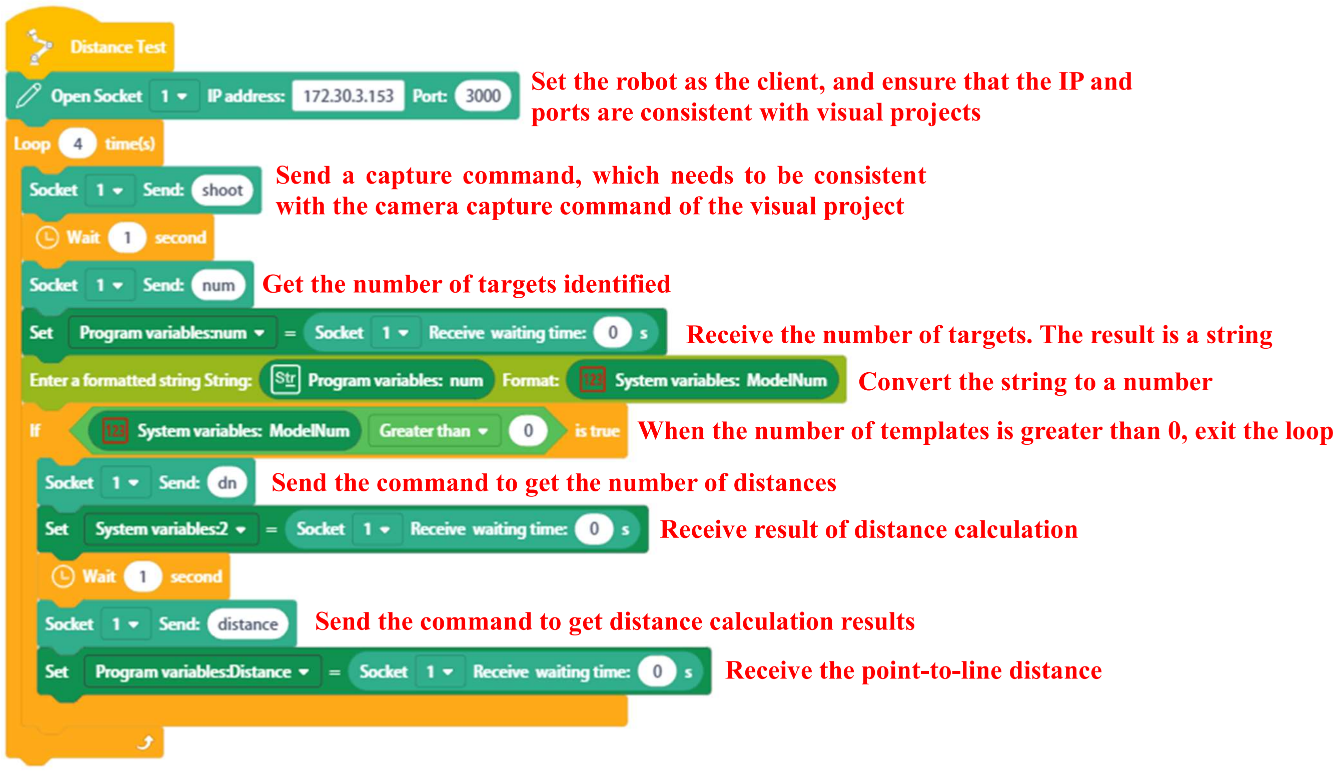

Figure 9.2.5 Robot program

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

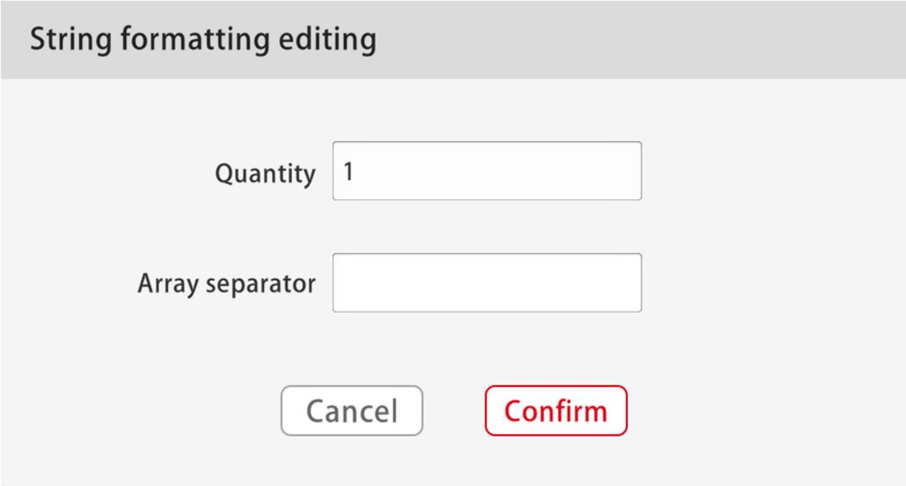

Figure 9.2.6 Enter the formatted string settings

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

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.

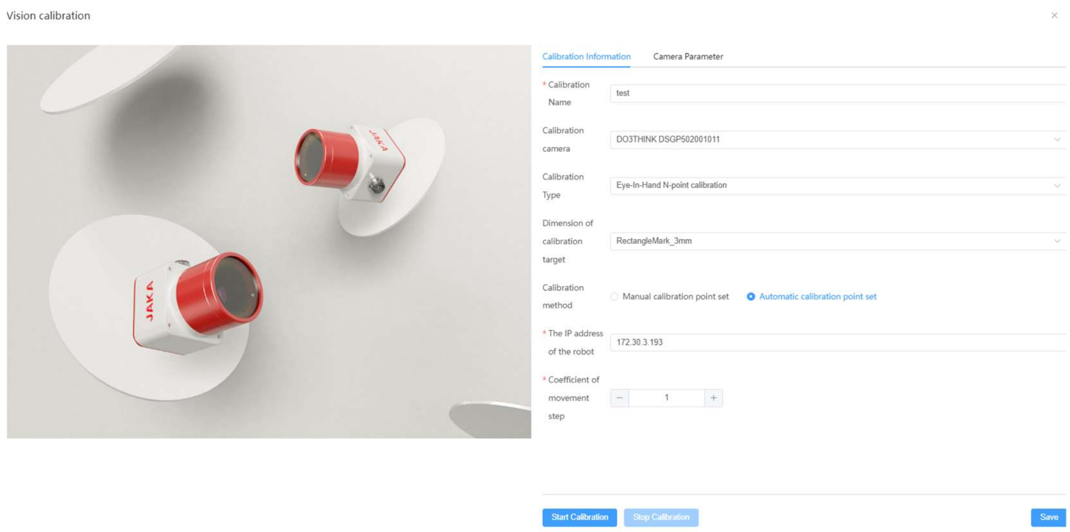

Figure 9.3.1 Visual Calibration

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.

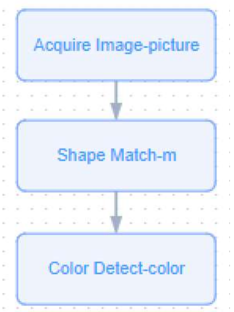

Figure 9.3.2 Visual Project

Figure 9.3.3 Template Matching

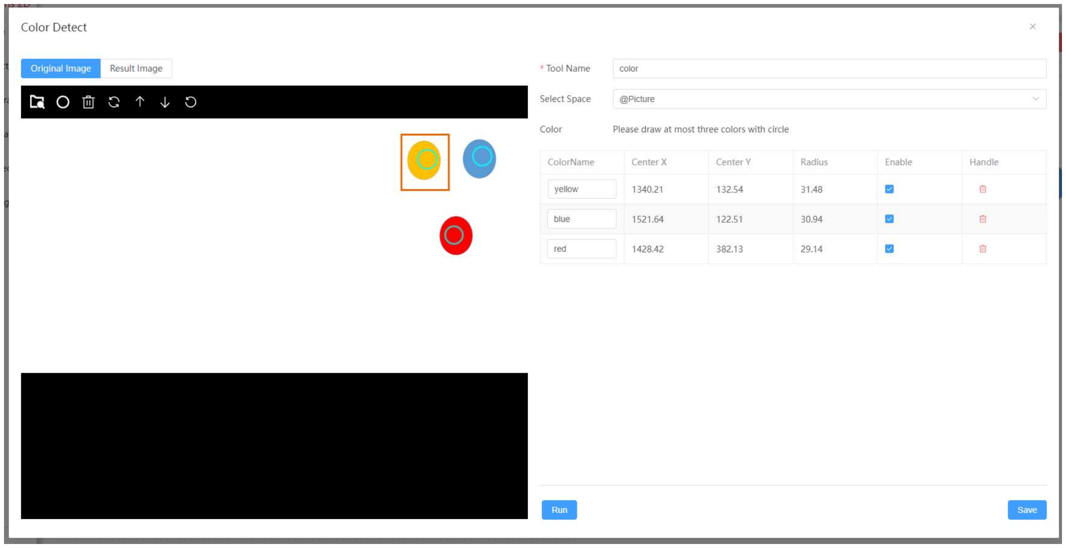

Figure 9.3.4 Color Recognition

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:

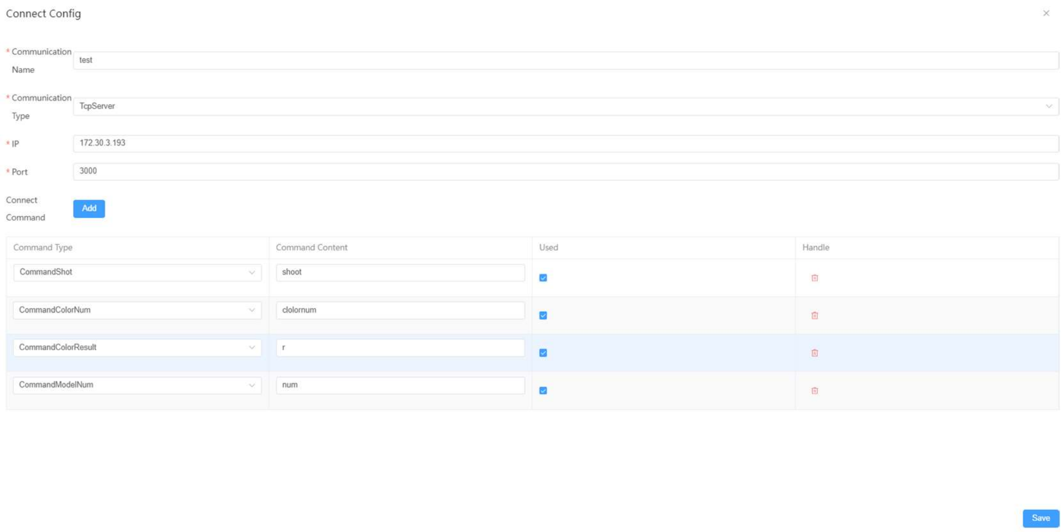

Figure 9.3.5 Communication Settings

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:

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.

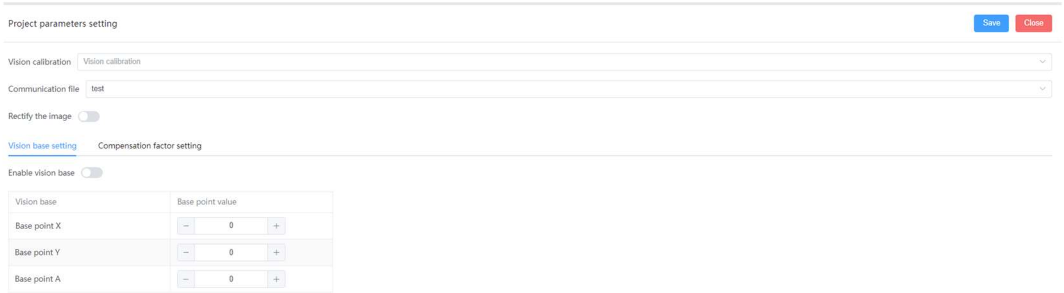

Figure 9.3.6 Project settings interface

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

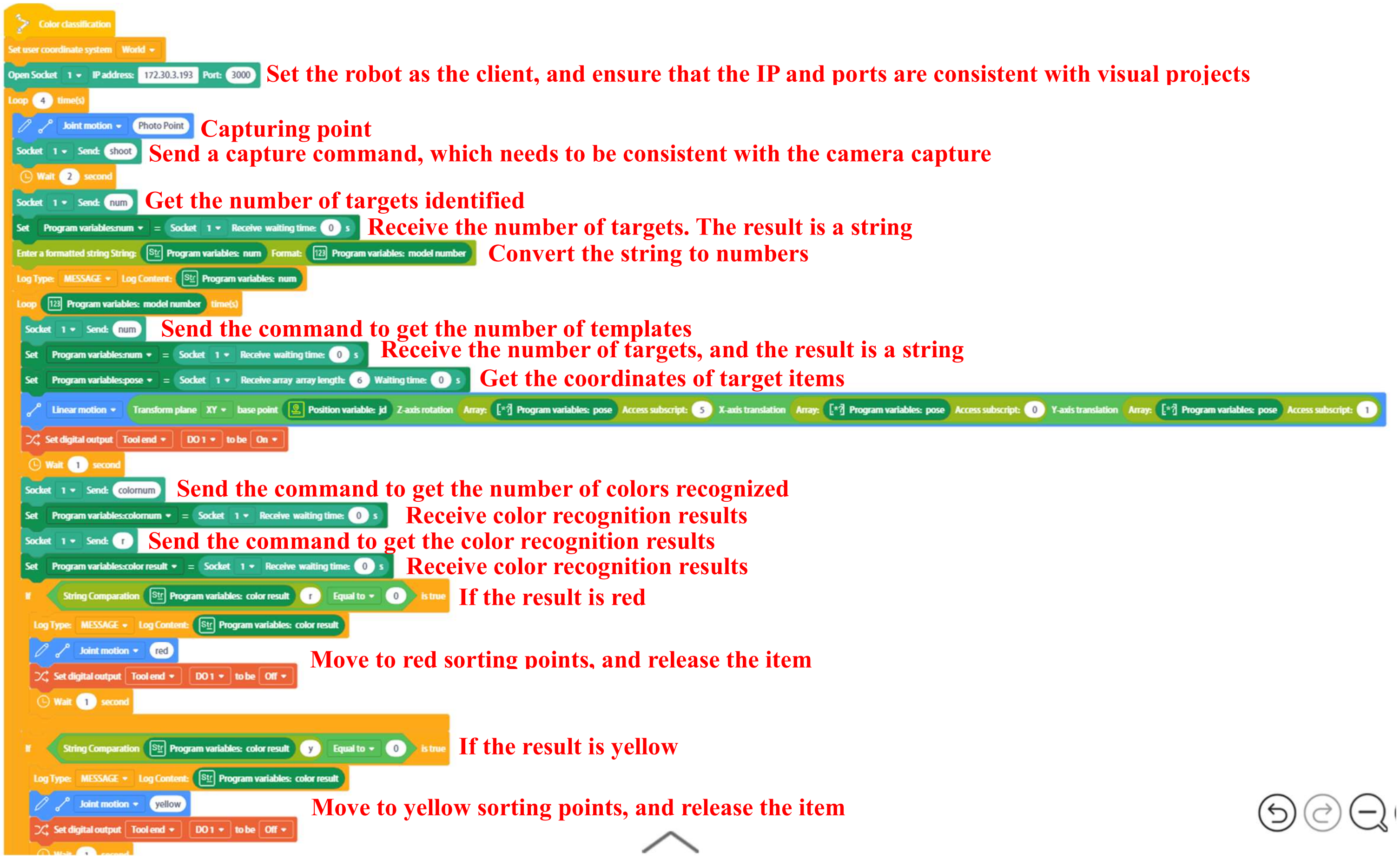

Figure 9.3.7 Robot program - N-point calibration

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:

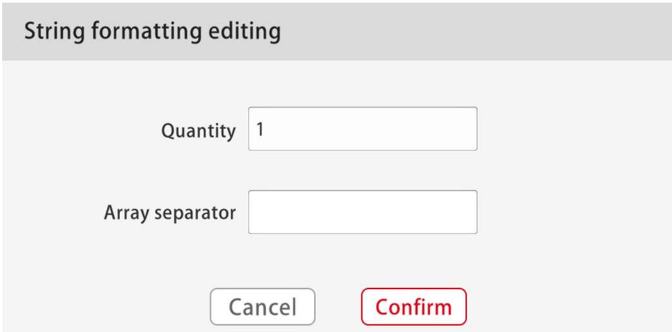

Figure 9.3.8 Enter the formatted string settings

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

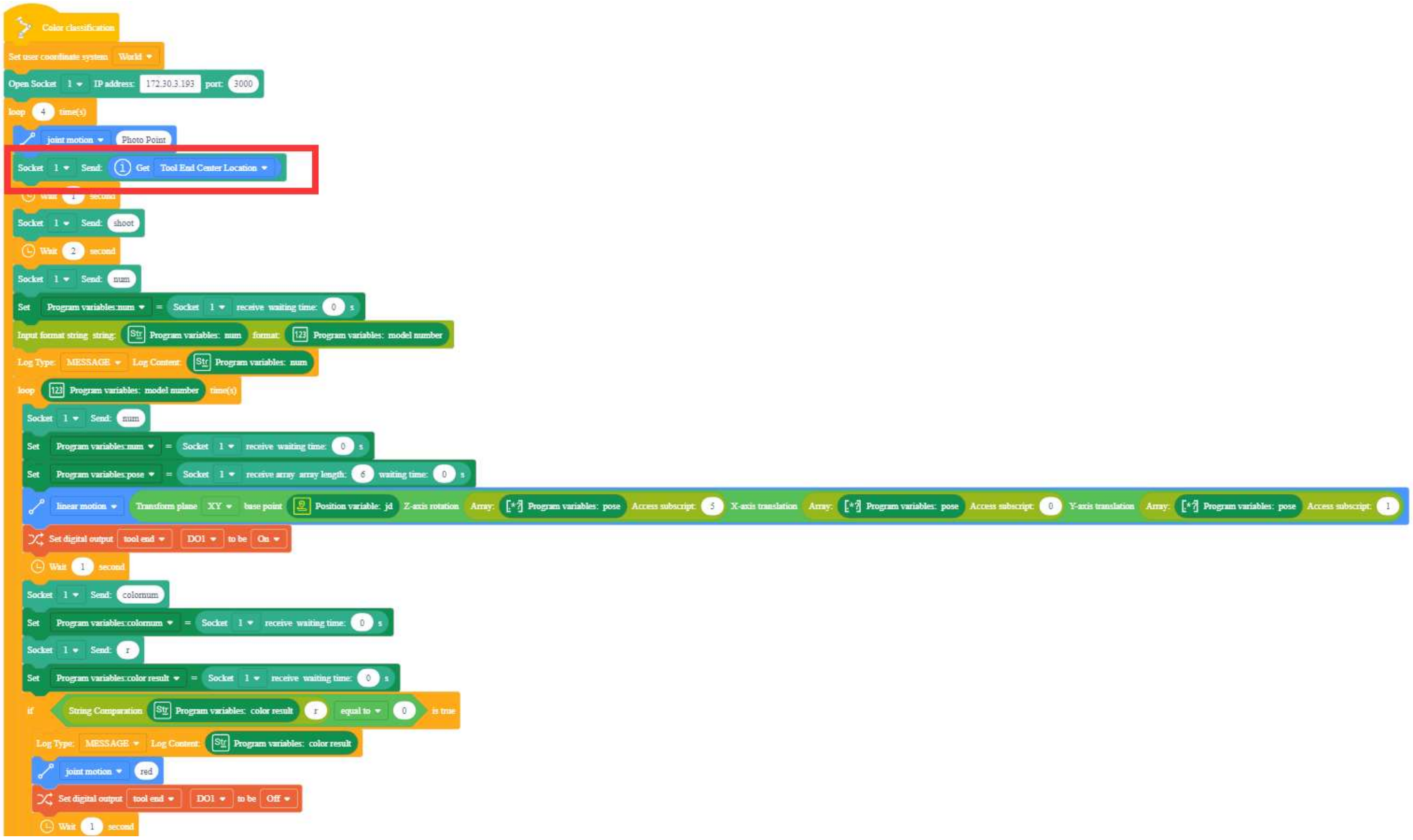

Figure 9.3.9 Robot program - Hand-eye calibration

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;

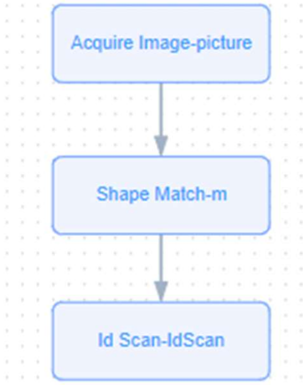

Figure 9.4.1 Vision project

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

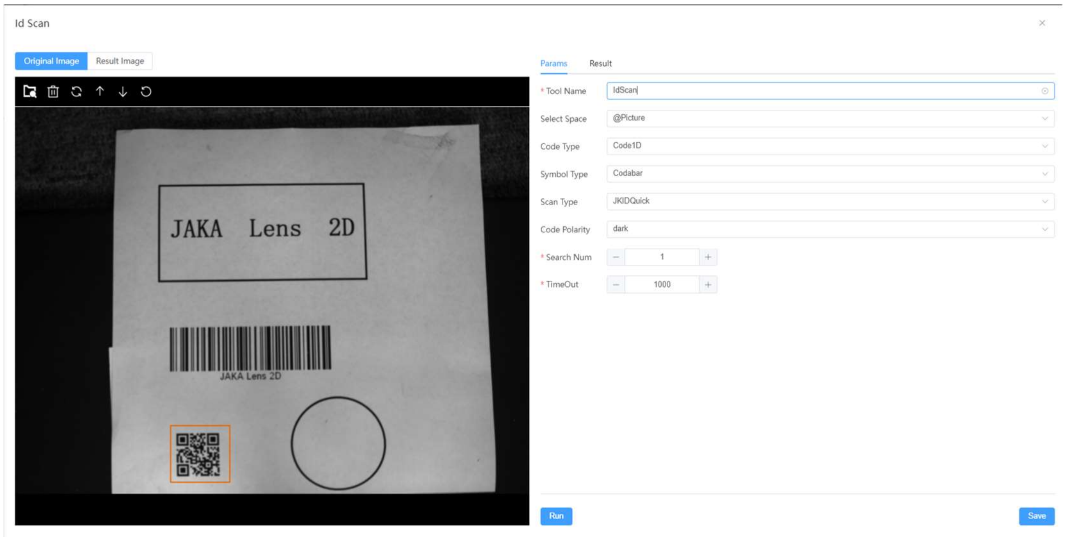

Figure 9.4.3 Scan code identification

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;

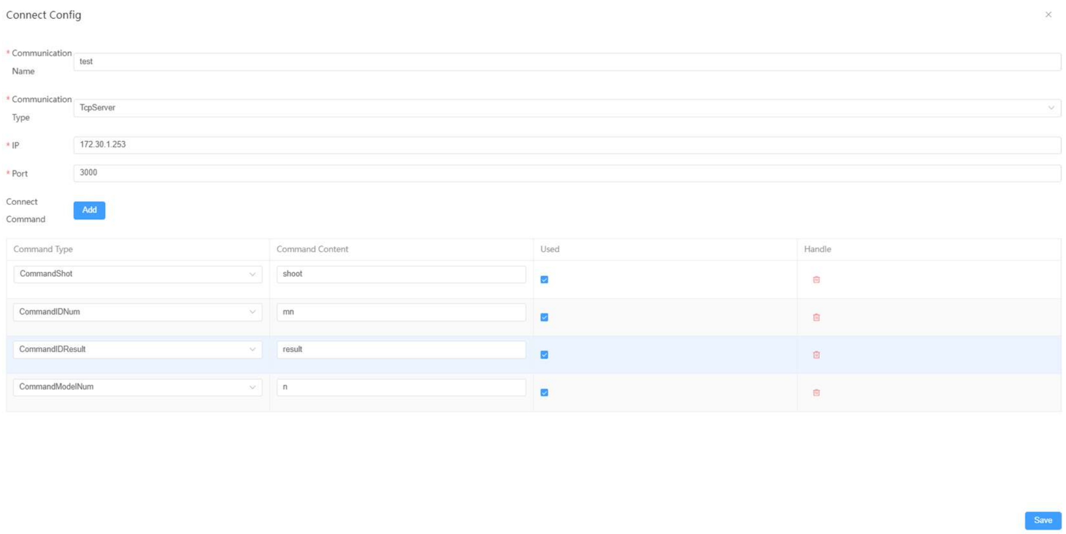

Figure 9.4.4 Communication Settings

Step 3: Project settings: in the project management interface, select the item you need to set from the project list, and click the setting 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.

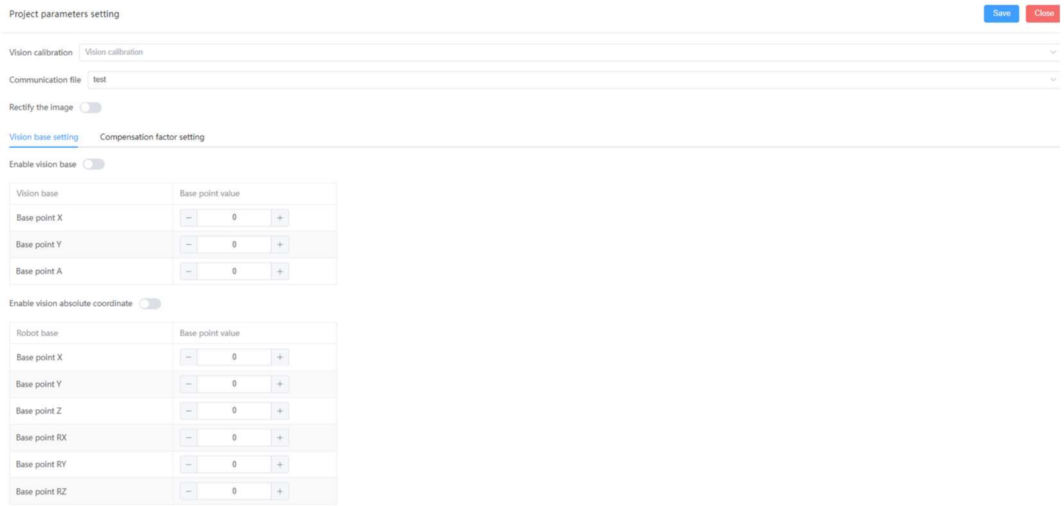

Figure 9.4.5 Interface of Project Settings

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);

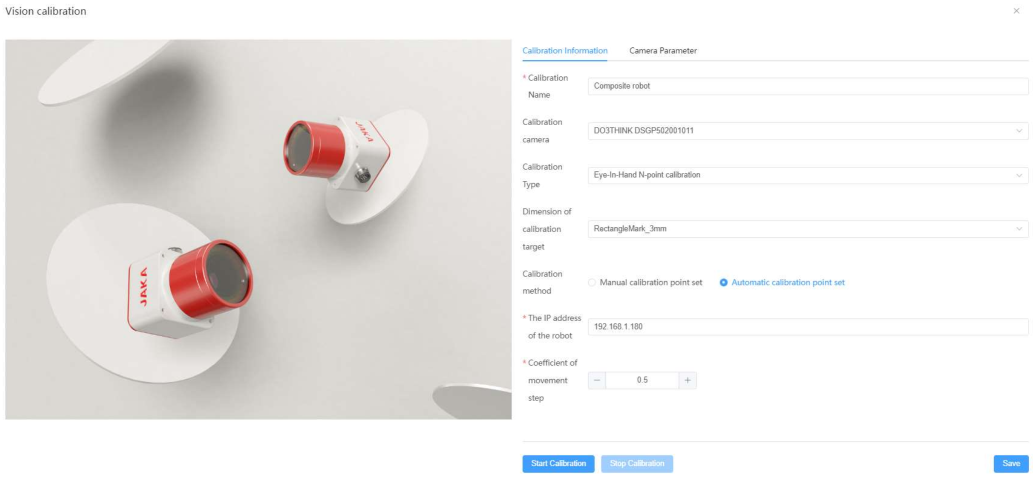

Figure 9.5.1 Visual Calibration

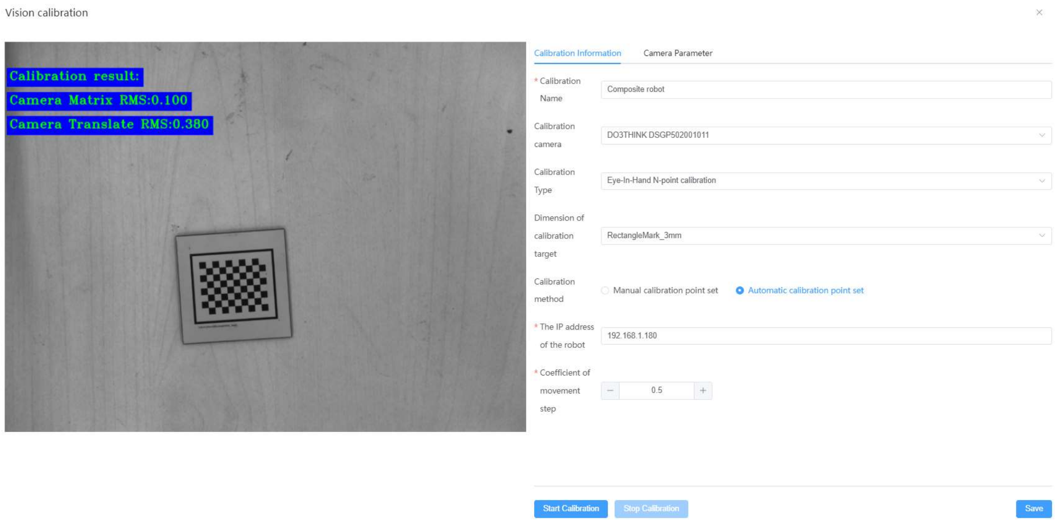

Figure 9.5.2 Calibration Result

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 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.

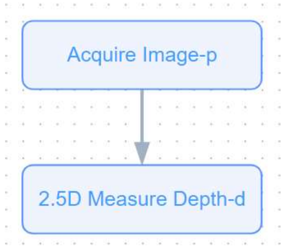

Figure 9.5.3

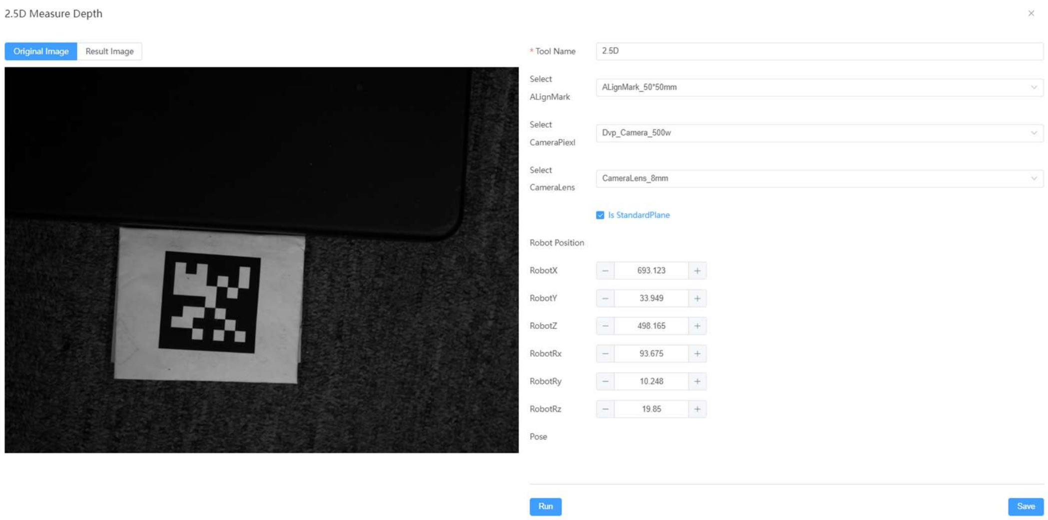

Figure 9.5.4

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:

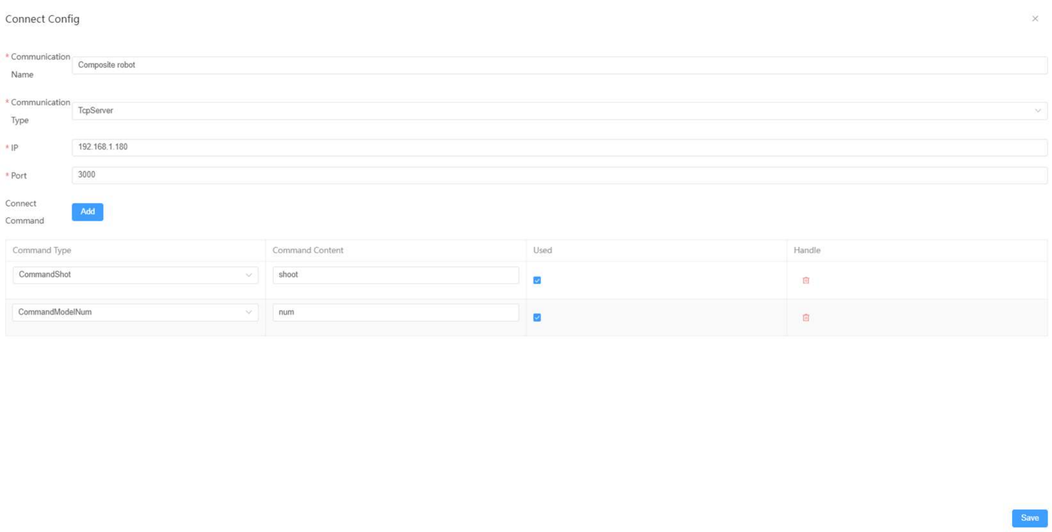

Figure 9.5.5 Communication Settings

Step 5: 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.

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:

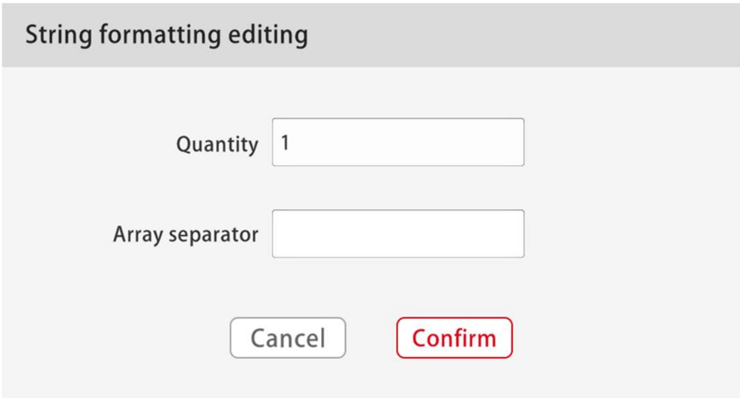

Figure 9.5.6 Enter the formatted string settings

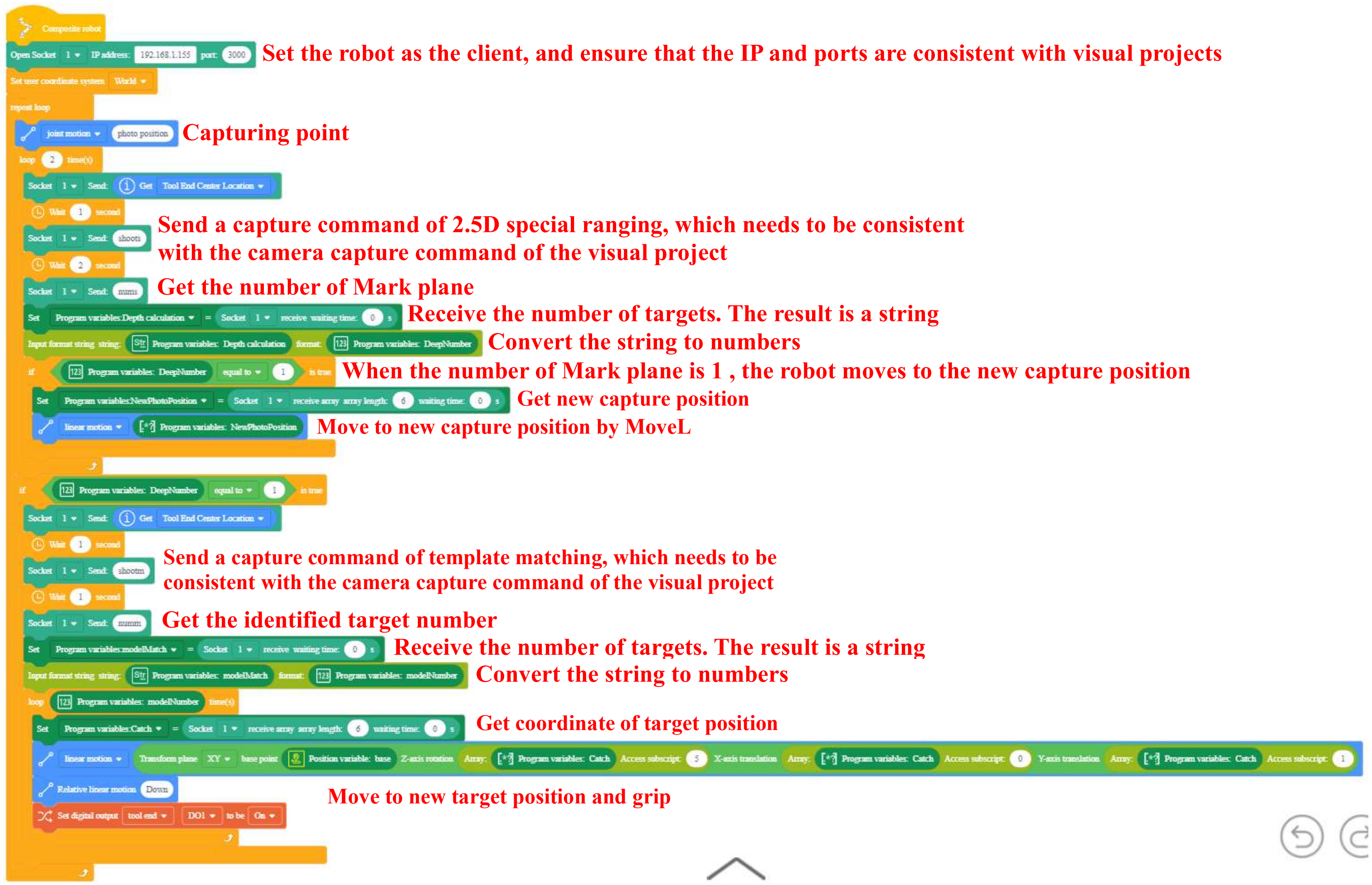

Figure 9.5.7 Robot Program

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