JAKA 节卡

Lens User Manual

JAKA Lens VPS

Version：2.1

Translated Instruction (en)

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 VPS must be familiar with its programming and system application and installation.

How to Read This Manual

This manual mainly contains the usage of Lens VPS, 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.

Contents

Foreword

Industrial robotic arms have been widely used in various industrial scenarios. They can be used for industrial applications such as parts grasping, assembly and material handling. Human-robot collaboration and human-robot interaction are an important development direction. JAKA collaborative robots are not only committed to these traditional operations in a portable and safe manner, but also pay attention to the interaction of the robot with human and environment during operation. Therefore, robot safety protection devices are becoming more and more indispensable.

This product aims to establish connection with robot controller by AI recognition technology and configuration of independent core processor and image processing system. As shown in Figure 1, the camera is placed at a certain angle on the top of the robot to monitor the working scene. When the inspected objects (people and objects) intrude into the monitoring area, the system processes and makes a judgment based on the acquired images, and then sends a signal to the robot to take measures to ensure the safety of people and machines. This is how the JAKA visual protection system works.

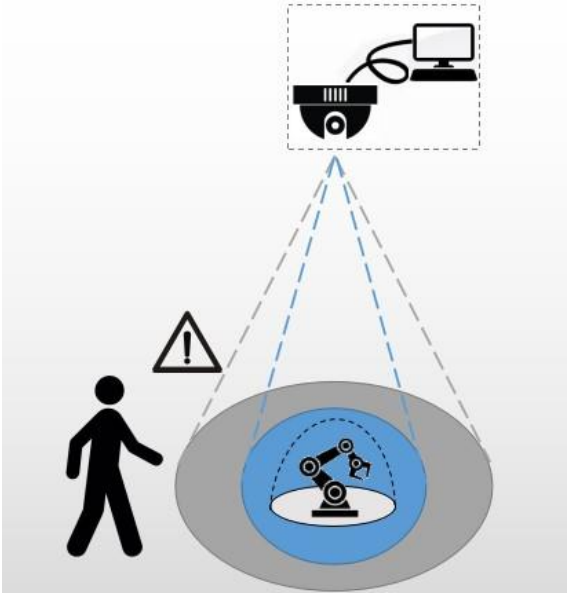


Figure 1 Working Diagram of Visual Protection System

Product List

When a complete set of JAKA visual system is purchased, a package list with details will be received, as shown in the table below (router, Pad and network cables should be self-provided):

Name	**Quantity**
JAKA Camera	1
Gigabit Network Cable	1
Serial Interface Cable	1
Terminal Block	1
Product Specification of JAKA Lens VPS	1

Chapter 1 Product and Function Introduction

1.1 Product Description

JAKA Visual Protection System 2.0 is developed based on a high-performance AI.SoC chip, equipped with high-speed and large-capacity memory and storage space, and embedded with a high-performance acceleration engine for AI functions such as target detection, object identification, human posture feature point extraction, behavior understanding, target state detection and so on. When the camera is placed on top of the robot, the camera can monitor the behaviors or intrusion of the inspected objects (people and objects) in real time based on deep learning, to ensure the safety of the robot and people. The parameters and functions of camera can be set on the web interface, which can set the protection area and monitor the protection area in real time. Meanwhile, the camera also features a Gigabit network port to support industrial data extraction and video visualization processing, as well as video recording during alarm periods.

The visual protection system consists of hardware and software. To realize the safety protection function, it needs the cooperation of visual protection camera, terminal block, robot and controller. In addition to the robot and controller, the visual protection camera in Figure 1.1 is the main hardware device for this product. The device has a built-in **high-performance AI.SoC chip and camera.** The operation on the software is realized through Web access, as shown in Figure 1.2.

Figure 1.1 Real Picture of the visual protection camera

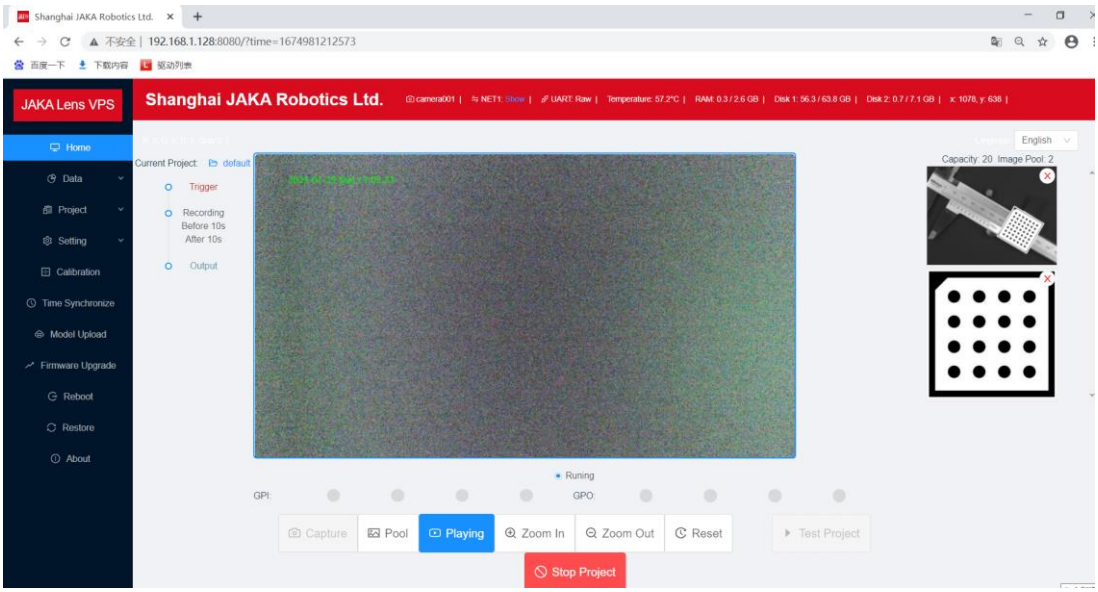


Figure 1.2 Web Client Operation Interface of Visual Protection System

1.2 Product Functions and Features

The JAKA Visual Protection System has the following functions and features:

1) Built-in neural network accelerators for AI recognition and analysis of video;

2) Event recording, to record key video segments, and eliminate redundant information for easier tracing and analysis;

3) Plug-and-play, no software installation, browser access to set parameters and projects, real-time monitoring.

4) AI functions such as detecting the helmet wearing, personnel target tracking, personnel labor intensity and video score calculation, etc.

5) IP67 protection class, applicable to a variety of complex industrial application environments.

Chapter 2 System Construction and Use

2.1 Construction of Visual Protection System

2.1.1 Camera Cable Connection

As shown in Figure 2.1, the camera has two interfaces, one 8-pin network cable interface (left side) which provides network communication and one 17-pin interface (right side) which provides power to the camera as well as I/O and serial interface signal transmission.

Figure 2.1 Camera Interface

Figure 2.2 Cable Connection

2.1.2 Terminal Block Connection

The camera's blue cable connects to the DB25 terminal board, and the external 24v power supply provides power to the camera via the wires in the diagram which

connect to the DC 24+ and DC 24-V of the terminal board respectively. The camera can also connect to external I/O devices via the four DI and four DO terminals. Here, the signal input is DI 1 and the signal output is DO 1. When the camera outputs a signal to an external I/O device, the indicator corresponding to "1" under [OUTPUT] will be on. When an external device inputs a signal to the camera, the indicator corresponding to "1" under [INPUT] will be on. When no external I/O device is available for debugging, the [TEST] button can be used as a temporary external I/O device. When the red button corresponding to "1" is pressed, it can simulate an external device and send a high level to the camera.

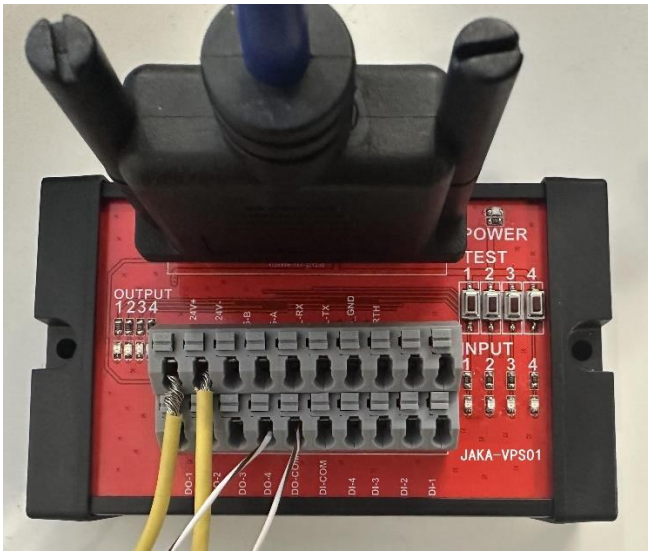


Figure 2.3 Terminal board wiring diagram

2.1.3 PC Network Settings

1. Factory default network settings of the camera: the default IP address of network port is 192.168.1.128; subnet mask is 255.255.255.0; gateway is 192.168.1.1.

2. When the camera is directly connected to the PC through the network port, it is necessary to ensure that the PC and the camera are on the same network segment or set by the network administrator. For example, the computer network interface card address is 192.168.1.129, mask is 255.255.255.0, and gateway is empty (or 192.168.1.1).

3. The camera is connected to a LAN through a router or switch. The network segment of the camera and the computer needs to be changed to the internal segment of the router, so that the camera web can be opened normally on the computer.

4. If the user uses multiple company cameras under the same LAN, the last digit of the IP address of each camera needs to be changed to different number, so as to prevents conflicts between multiple cameras with the same IP address from rendering the device unusable. Similarly, the IP address of the camera should not be the same as that of other devices under the same LAN. If the user uses the camera under different LAN, the IP address of the camera shall be set according to the requirements under individual LAN separately.

5. The operation steps for modifying the network settings on the PC are as follows:

Open [Control Panel]→[Network and Internet]→[Network and Sharing Center]→[Change Adapter Configuration] on the PC. Select the corresponding network port and configure the IP of the network port to the same network segment as the camera in the format of 192.168.1.xxx, for example, 192.168.1.105 as shown in Figure 2.4 (the default IP of the camera is 192.168.1.128).

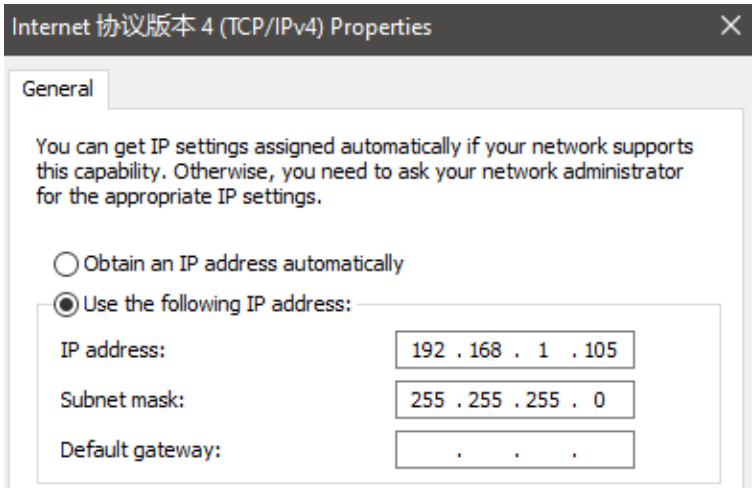


Figure 2.4 IP Settings

Check whether camera can PING. Enter PING 192.168.1.128 in the computer operation input box as shown in Figure 2.5

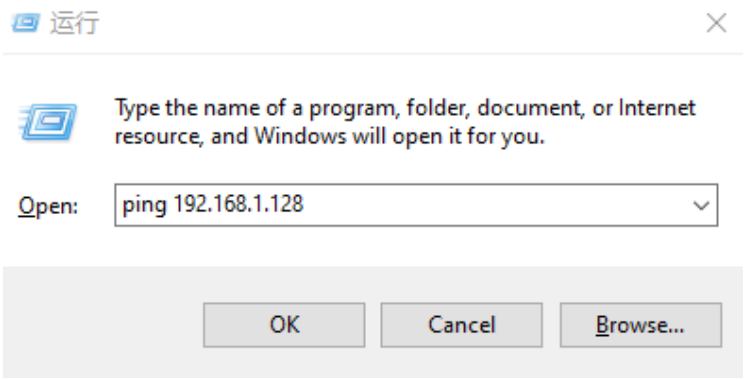


Figure 2.5 IP Address Input

If there is data transmission and transmission time, it means the network is connected. If the request is delayed, it means the network is not connected. Please check:

1) Whether the network cable is plugged in;

2) Whether the camera cable is connected;

3) Whether the network segment is set correctly.

NOTE:

For the procedure to modify the camera network settings, please refer to the next chapter about camera web.

2.1.4 Web Client Access

The camera's default IP is 192.168.1.128. After the camera is powered on, open a browser and enter the IP address of the camera (enter 192.168.1.128) to access the device's Web login page, as shown in Figure 2.6. The Browser is required to support HTML5. Google and Firefox are recommended.

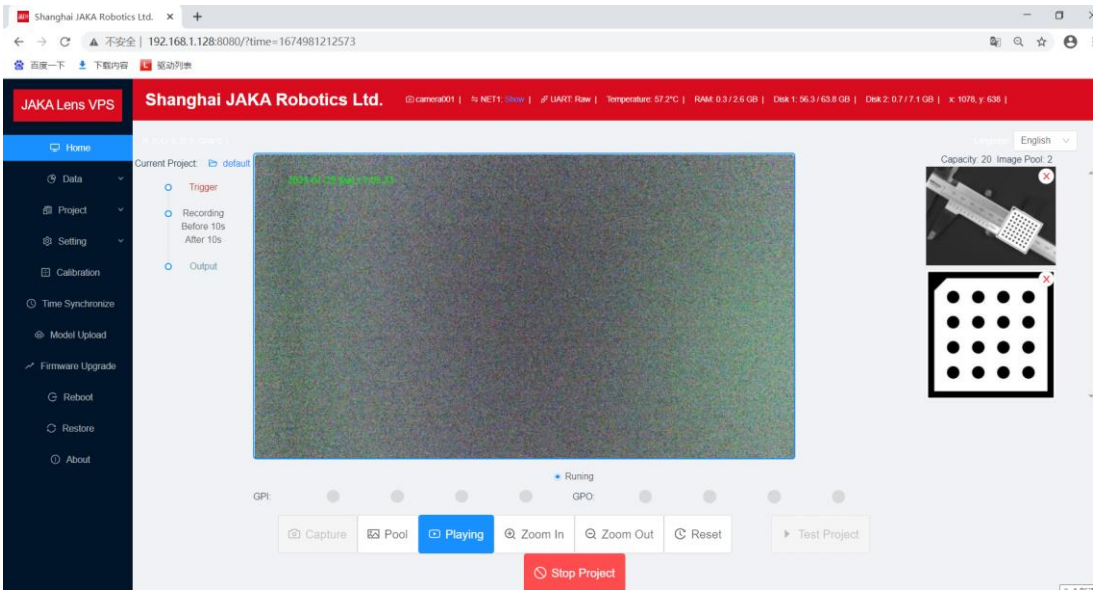


Figure 2.6 IP Address Input

NOTE:

The Web Client is fully compatible with Google Chrome, but is not compatible with Internet Explorer and Edge browsers. If user is experiencing unusual problems with other browsers, please install Google Chrome and try again.

2.2 Function Setting

Power on the visual protection device and the visual protection system is ready to work. All programs have been set to start automatically, so **turning on and off the visual protection system is realized by powering it on and off.** With the visual protection system is turned on, the protection area can be modified on the Web.

Chapter 3 Web Operations

3.1 Web Client Access

The device does not require software installation. Open the browser and enter the IP address to enter the device's login page where to set parameter and operate. The software interface is divided into a navigation bar, menu bar, working area, and button area.

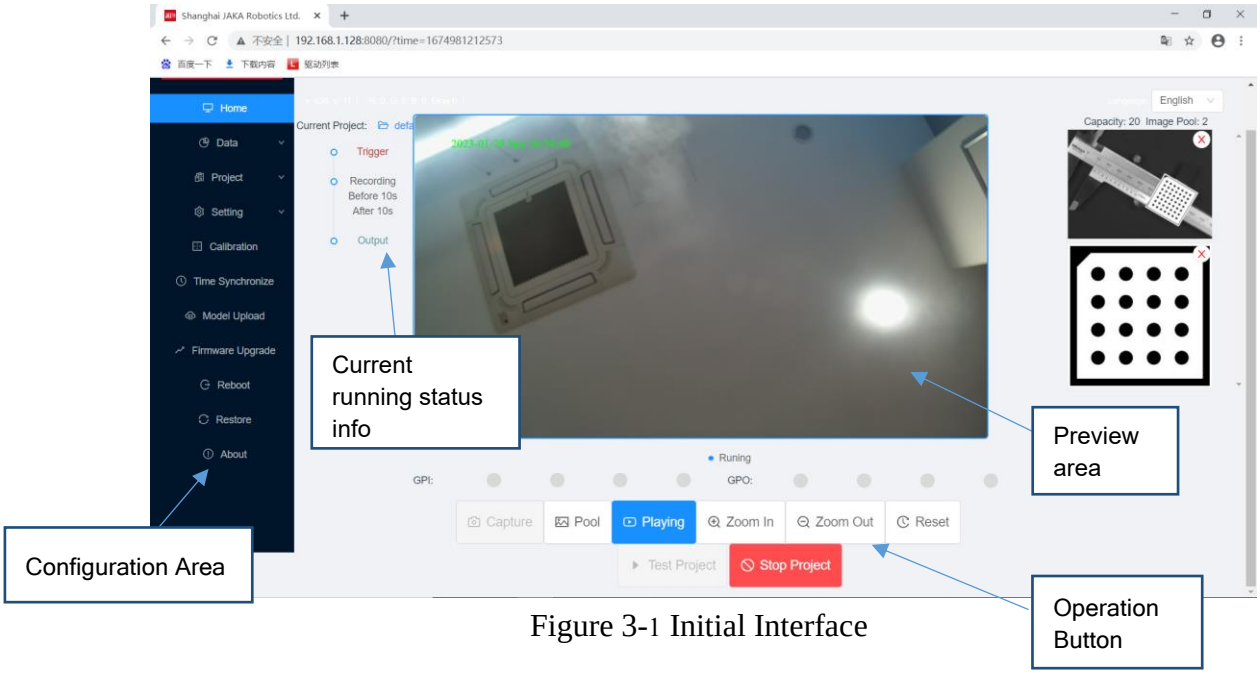


Figure 3-1 Initial Interface

NOTE:

Ensure PC is on the same IP network segment as the camera before login.

3.2 Navigation Bar

Figure 3-2 Navigation Bar

As shown in Figure 3-2 Navigation Bar , the navigation bar shows the current trigger mode of the camera, the communication method, the number of success/failure of the operator, the x and y position of the mouse in the working area and the RGB of its pixels, etc. to provide important info for the user. Figure 3-2 Navigation Bar

3.3 Menu Bar

As shown in Figure 3.3, the menu bar includes Home, Data, Project, Settings, Camera Calibration, Time Synchronize, Model Upload, Firmware Upgrade, Restore Factory Default Settings, and About which correspond to different functions of the system.

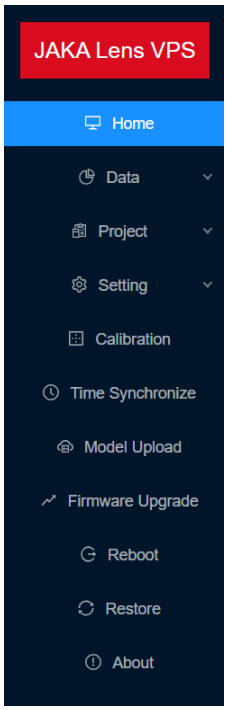


Figure 3.3 Menu Bar

3.4 Working Area

Figure 3.4 Working area The current project name can be seen on the right side of the working area, and the lower side indicates the running status (Running/Stop). Click on the project name to jump to the project configuration. At the same time, user can perform some operations in the working area, such as painting ROI area, rotating image, etc (see the Chapter 5).

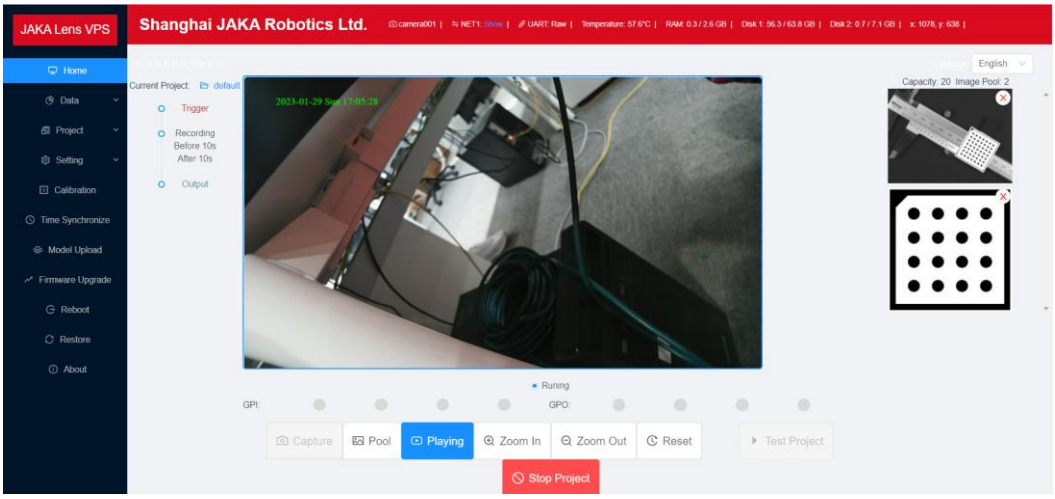


Figure 3.4 Working area

3.5 Button Area

The button area provides 7 basic operation buttons. As shown in Figure 3.5, the camera's default operating state is Running. When running the current default project, the video can be previewed but not for a single photo shot. Figure 3.5 Running Status

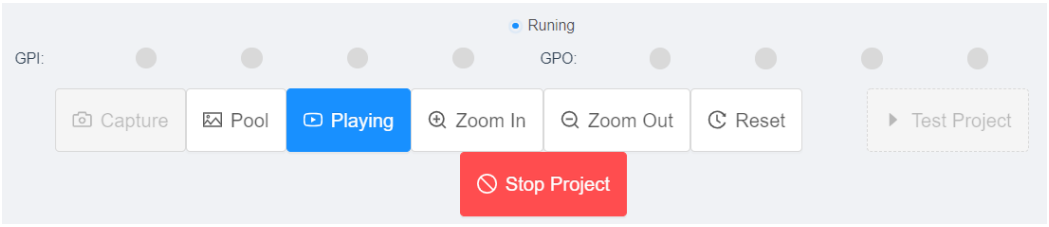


Figure 3.5 Running Status

As shown in Figure 3.6, click the rightmost [Stop] button, the button turns blue. The camera enters Stop state, and click the [Capture] button to activate.

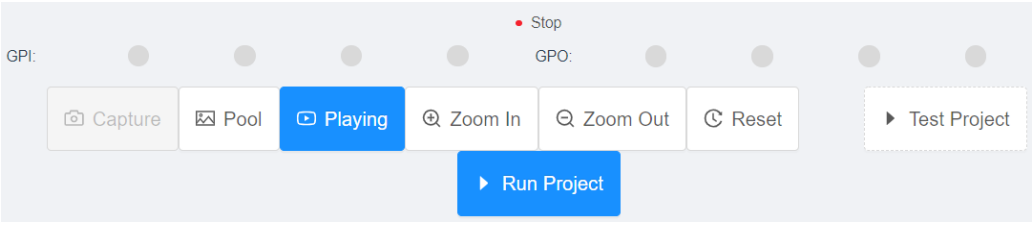


Figure 3.6 Stop state

When the [Capture] and [Playing] buttons are clicked, image changes in the working area can be seen. As shown in Figure 3.7, click [Zoom in] button to zoom

in the image in workspace; click the [Zoom Out] button to zoom out the image on the working area. Click the [Rotate] button and a drag bar appears to manipulate the angle of rotation of the image in working area. Click the [Restore] button. Restore the image in working area to its original size and the rotation angle to horizontal.

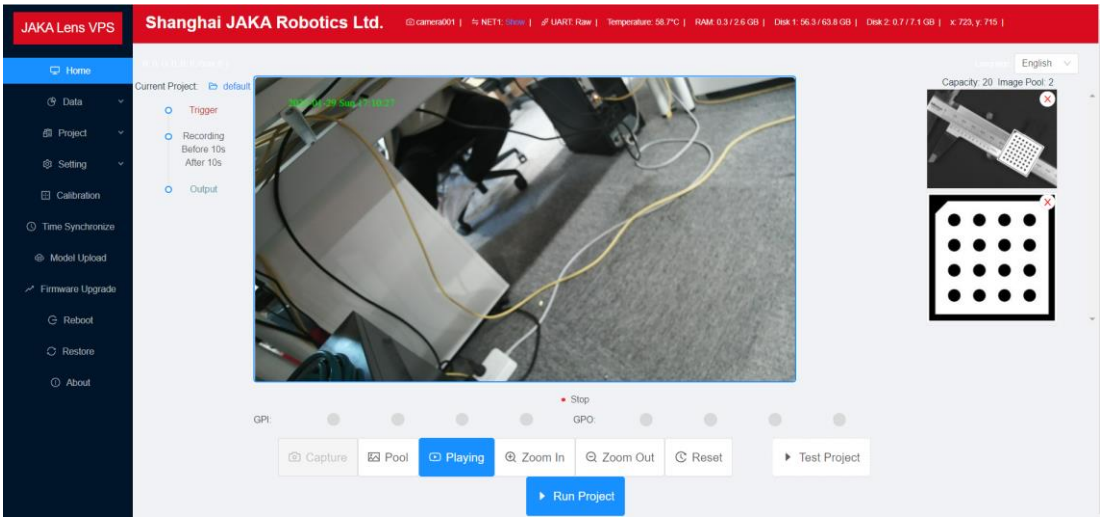


Figure 3-3 Preview Status

3.6 Data Management

Data management is divided into image storage management, video management, and log management. It is used to search for videos, pictures, and logs generated by camera work.

1. Image Storage Management

Image Storage Management is used for image management after images storage. When there are images stored to the camera, the captured images can be viewed in Image Storage Management. If multiple images need to be downloaded or deleted, select the check box before the corresponding image, and the topmost checkbox is for Select All option, as shown in Figure 3.8.

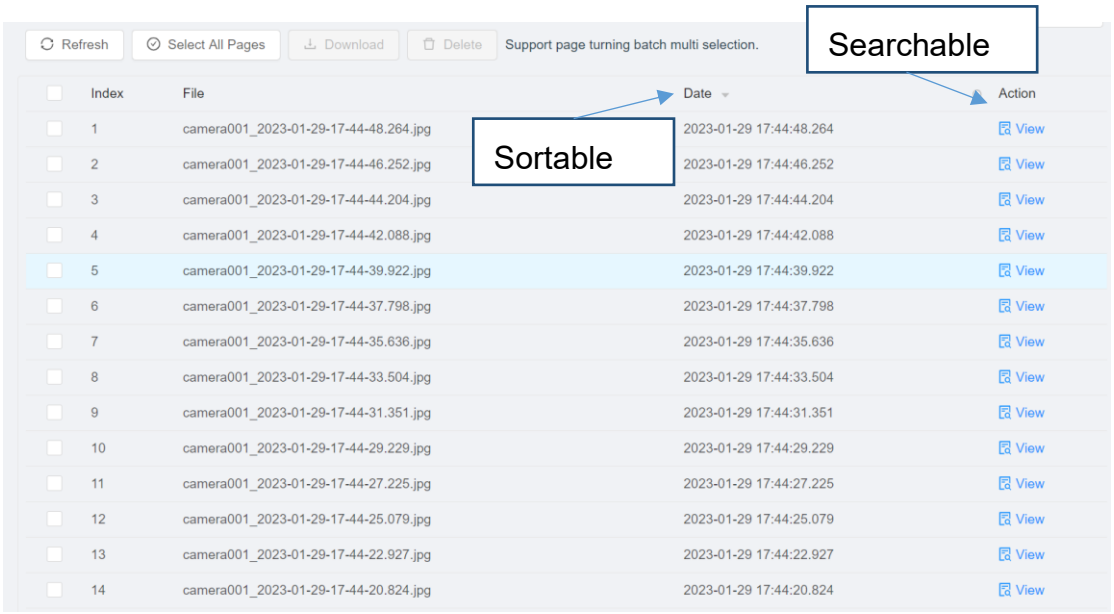


Figure 3.8 Image Storage Management

2. Video Management

The video management interface is used to manage the video files.

When a video is stored in the camera, click the operation behind the file in the video list to play the video. If multiple videos need to be downloaded or deleted, select the check box in front of the corresponding video and click the corresponding operation button; Click the button next to the [Date] to sort by time, or click the button in front of the [Duration(s)] to search, as shown in Figure 3.9.

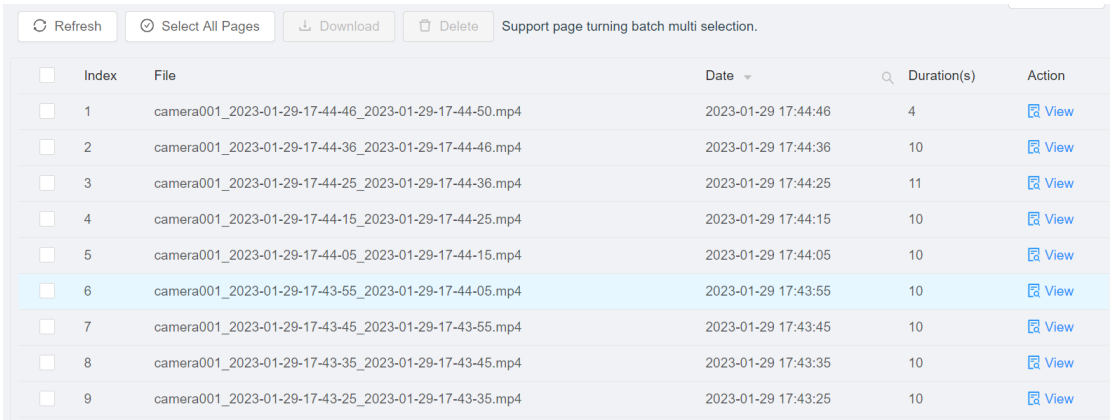
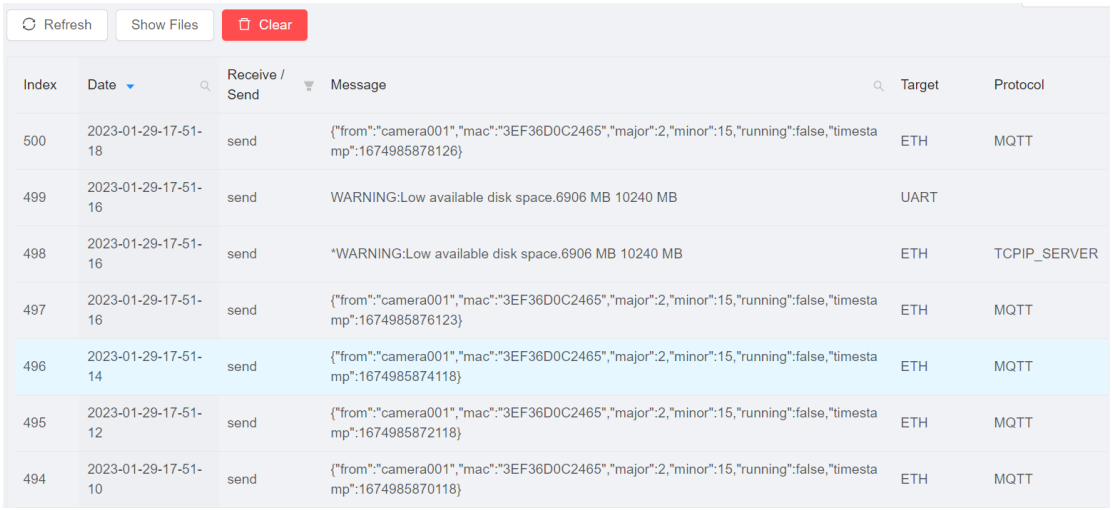


Figure 3.9 Video Management

3. Log Management

The log module is mainly used to view the operation related to the device and the Web operation log, as shown in Figure 3.10.



Index	Date	Receive / Send	Message	Target	Protocol
500	2023-01-29-17-51-18	send	{"from":"camera001","mac":"3EF36D0C2465","major":2,"minor":15,"running":false,"timestamp":1674985878126}	ETH	MQTT
499	2023-01-29-17-51-16	send	WARNING:Low available disk space.6906 MB 10240 MB	UART	
498	2023-01-29-17-51-16	send	*WARNING:Low available disk space.6906 MB 10240 MB	ETH	TCPIP_SERVER
497	2023-01-29-17-51-16	send	{"from":"camera001","mac":"3EF36D0C2465","major":2,"minor":15,"running":false,"timestamp":1674985876123}	ETH	MQTT
496	2023-01-29-17-51-14	send	{"from":"camera001","mac":"3EF36D0C2465","major":2,"minor":15,"running":false,"timestamp":1674985874118}	ETH	MQTT
495	2023-01-29-17-51-12	send	{"from":"camera001","mac":"3EF36D0C2465","major":2,"minor":15,"running":false,"timestamp":1674985872118}	ETH	MQTT
494	2023-01-29-17-51-10	send	{"from":"camera001","mac":"3EF36D0C2465","major":2,"minor":15,"running":false,"timestamp":1674985870118}	ETH	MQTT

Figure 3.10 Log Management

Chapter 4 Camera Settings

The chapter mainly includes basic settings, ISP settings, communication settings, etc.

4.1 Camera Settings

Here are mainly some basic settings of the camera, to name the camera and modify the navigation bar;

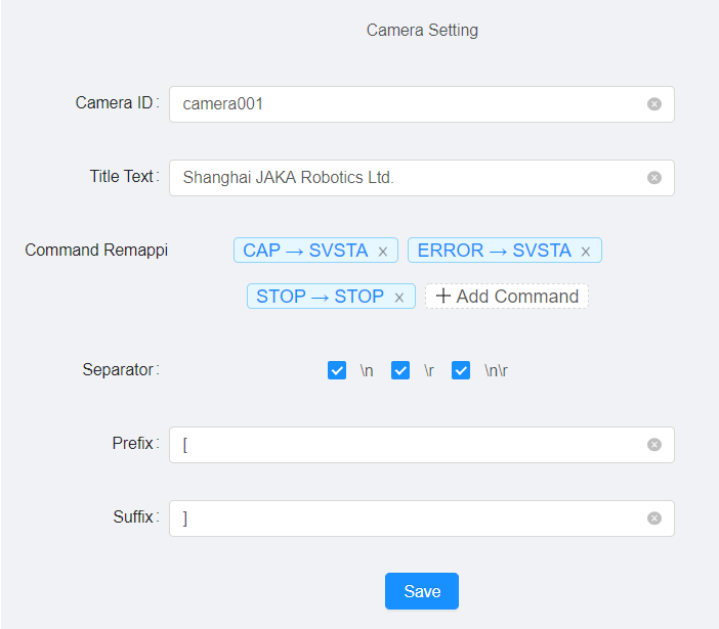


Figure 4.1 Basic Camera Settings

4.2 ISP Settings

The image parameters include photo resolution, video resolution, exposure, white balance, contrast, saturation and sharpening. 错误!未找到引用源。These parameters can be set according to your need.

Click the [ISP Settings] button to set the camera's photo resolution, video resolution, exposure, white balance, contrast, saturation, and sharpening. Click [Modify] to submit. As shown in 4.2.

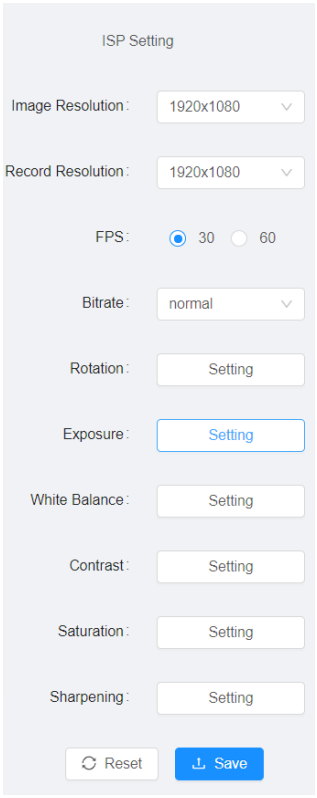


Figure 4.2 ISP Settings **错误!未找到引用源。**

NOTE:

This is an overall settings, applicable to all projects. There are a few partial settings in the current project. When the camera is running, the partial settings take priority.

4.3 GPIO Debugging

This function interface is mainly used for testing of the camera I/O output loops. The camera has 8 I/O ports, 4 GPIO-IN and 4 GPIO-OUT signals. See Figure 4.3.Figure 4.3 GPIO Debugging

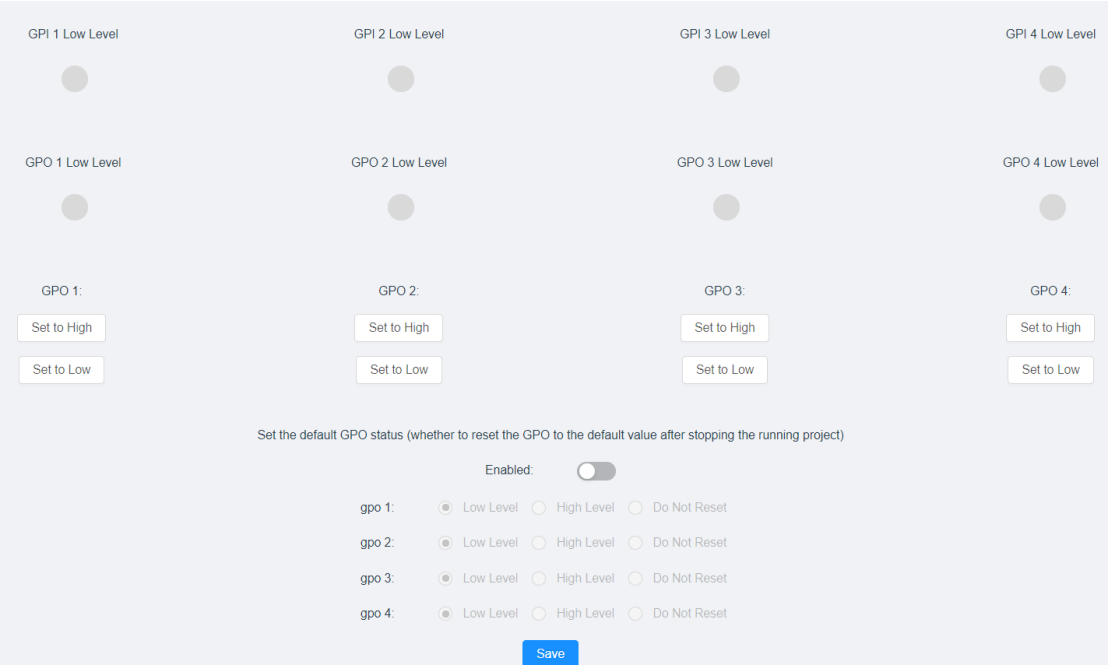


Figure 4.3 GPIO Debugging

The GPIO of the camera uses the PNP structure whose initial setting is low level if there is no signal and high level if there is signal.

When debugging GPI, the external signal input can be simulated through the physical button on the terminal block. When there is a high-level input, the GPI indicator flashes blue.

When debugging GPO, high level or low level can be output by clicking the button on this interface.

NOTE:

This setting can be performed only when the camera project is stopped.

4.4 IP Settings

Click the [NIC Settings] button to enter the NIC setting interface. The camera has a NIC that can be set up to connect to a separate network. The IP address of the NIC can be set according to the user's own situation, and the default IP address of the NIC is 192.168.1.128, as shown in Figure 4.4. Figure 4.4 Network Interface Card SettingsThe user needs to set the IP address of the NIC in the same network segment when setting the IP address, such as 192.168.1.xxx. **(The camera needs to be restarted after changing the camera IP address, either through the reboot**

button on the page or by powering off).

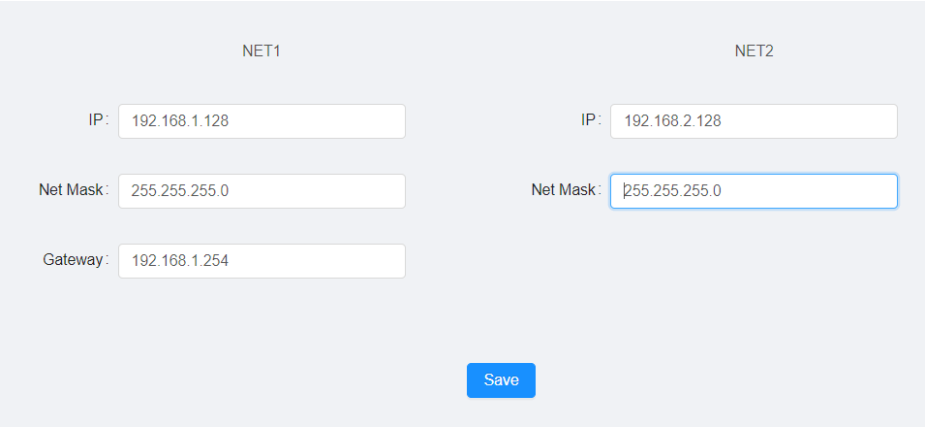


Figure 4.4 Network Interface Card Settings

4.5 Communication Settings

Click the [Communication Settings] button to enter the communication settings interface, to set the communication method of the camera.

The current network communication supports Socket, TCP/IP Server, TCP/IP Client, and Modbus TCP/RTU. When switching to different protocols, there are different corresponding parameter modifications. The IP address and port number of the server can also be set. Uart485 communication is in free message mode. The setting interface is shown in Figure 4.5. Figure 4.5 Communication Settings

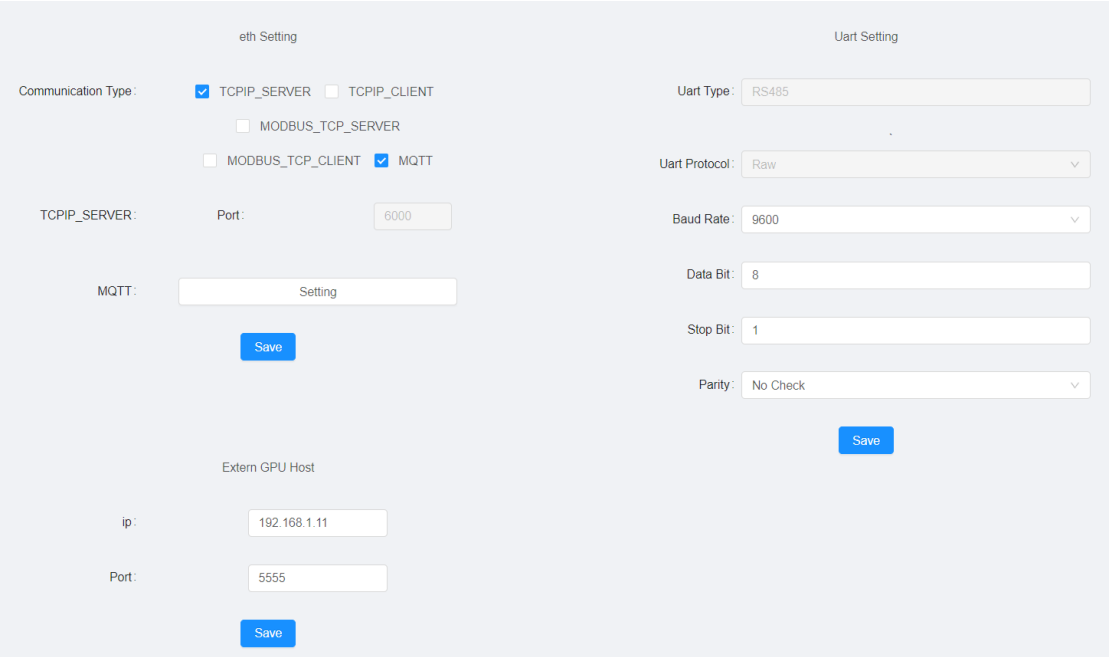


Figure 4.5 Communication Settings

4.6 FTP Settings

Click the [FTP Settings] button to enter the FTP settings interface.

In the FTP settings, the videos and pictures can be saved inside the camera or in an external FTP server. Follow the prompts to fill in the relevant parameters. As shown in Figure 4.6. Figure 4.6 Storage Settings If it is saved inside the camera, the saved videos and pictures can be viewed through the data management function.

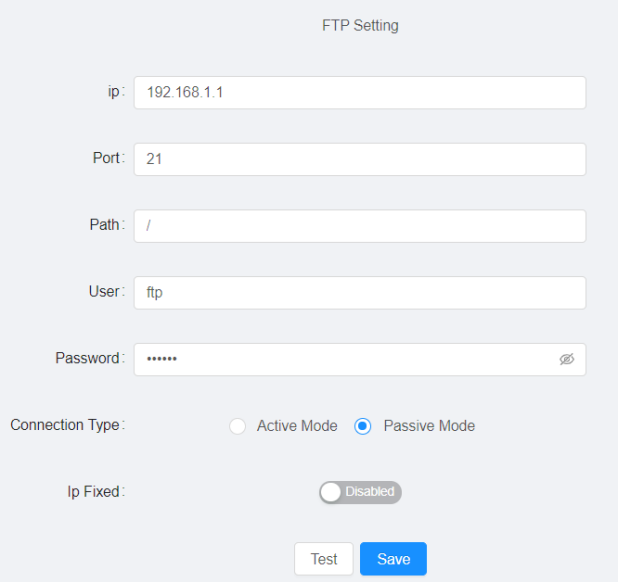


Figure 4.6 Storage Settings

NOTE:

1) The user must ensure that the parameters are set correctly and that the FTP path already exists. If the FTP path entered does not exist, the camera will not automatically create the catalogue. Transferred videos and pictures will be on hold.

2) When the FTP server is behind the NAT network and set to passive mode, if the network administrator forgets to set the FTP external IP address, the camera will not be able to upload pictures. At this time, turn on the IP correction switch to try to solve the problem.

4.7 HTTP Settings

Click the [FTP Settings] button to enter the FTP settings interface.

The camera can upload JSON messages to the HTTP server in POST mode.

The URL is the address of the server; the login name and password can be filled in as appropriate or empty. The interface is shown in Figure 4.7.

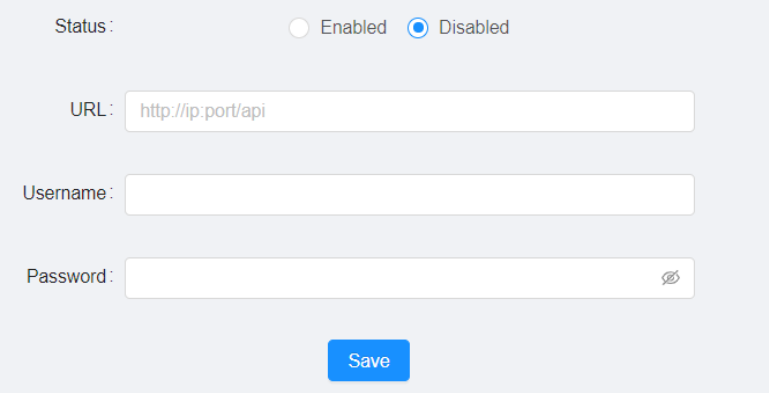


Figure 4.7 FTP Settings

4.8 System Settings

4.8.1 Time Calibration

The time calibration module is mainly used to synchronize the time of the device and other PCs or servers. It supports manual time calibration and NTP time calibration.

1) Manual time calibration: Check "Manual Calibration" and enter the device time manually, or turn on the "Synchronize with Local Time" button to keep the device time consistent with the local computer. But some camera models will revert to the default time after the camera is manually calibrated and rebooted, as shown in Figure 4.8.

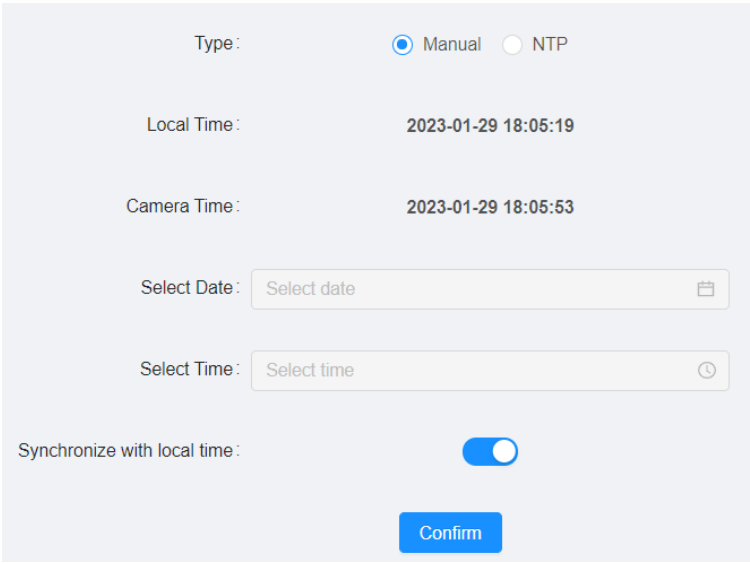


Figure 4.8 Time Calibration

2) NTP time calibration: The NTP server address, NTP port number and calibration time intervals can be set. The device can calibrate periodically according to the settings. Before use, external NTP server needs to be set up, as shown in Figure 4.9. Figure 4.9 NTP Time Calibration

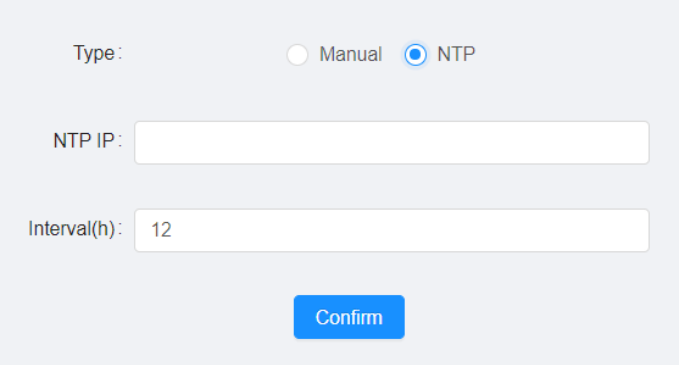


Figure 4.9 NTP Time Calibration

3) The camera needs to be in a stopped state before calibration.

4.8.2 Firmware Upgrade

The firmware upgrade interface allows to view the current firmware version of the device and to perform firmware upgrade operations. When upgrading the firmware, make sure the running status of the device is Stop. Select the upgrade file and click "OK" to upgrade the firmware. As shown in Figure 4.10.

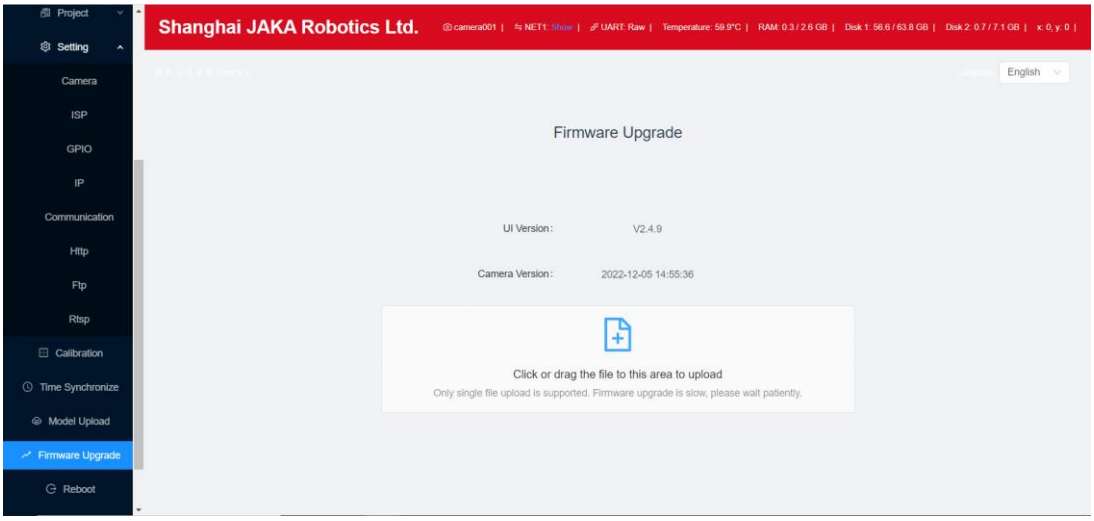


Figure 4.10 Firmware Upgrade

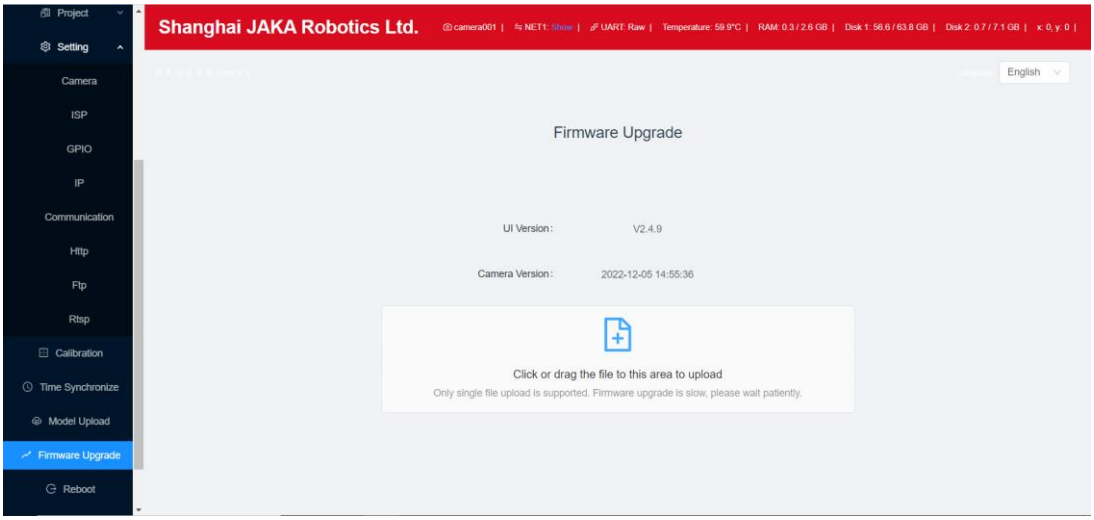


Figure 4.10 Firmware Upgrade

Click the [Select File] button and select the upgrade file. After confirmation, click the [Upload] button. After the file is uploaded, the page will give a prompt and automatically restart twice without manual operation. It takes about 3 minutes to reboot and upgrade, then go back to working state. Please be patient during the upgrade process. A power failure during the upgrade process may cause the camera fail to turn on properly.

4.8.3 Restore Factory Defaults

The Restore Factory Default Settings module can restore the device to its factory default settings. As shown in 4.11.

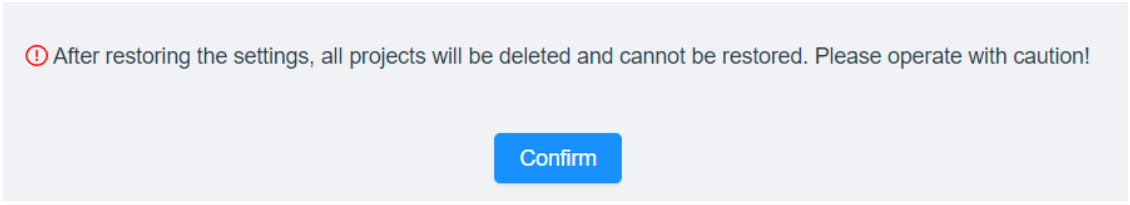


Figure 4.11 Restore factory default settings

After clicking [Restore] button, a confirmation dialog box will pop up. Click [OK] and the camera automatically reboots once. It takes about 1 minute to get back to the working state. Please be patient during the recovery process. A power failure during the recovery process may cause the camera fail to turn on properly.

NOTE:

After restore the camera, the device program and related data will be deleted and cannot be recovered

Chapter 5 Practical Use and Configuration

5.1 Hardware Wiring

The camera and the terminal block are connected with a network cable, and the terminal block and CAB (IO type is PNP) or MiniCab (IO type is NPN) are connected as shown in Figure 5.1 and 5.2.

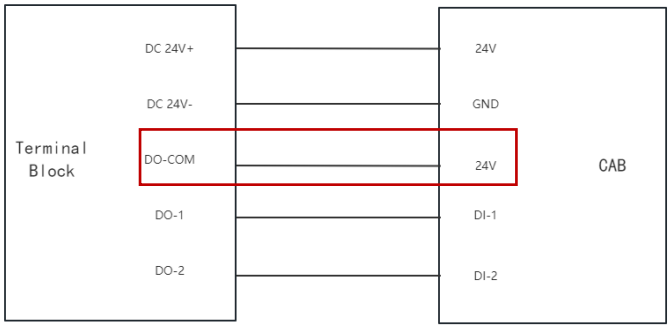


Figure 5.1 Terminal block and CAB wiring diagram

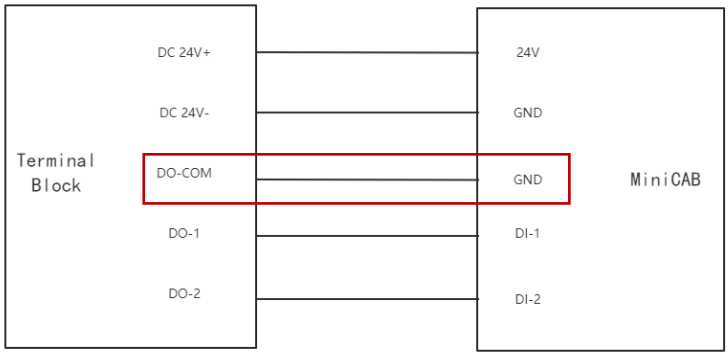


Figure 5.2 Terminal block and MiniCab wiring diagram

5.2 Robot IO Settings

By connecting the terminal block DO directly to the robot CAB DI, the detected signal from the camera can be transmitted directly to the robot, so that the monitoring information of the visual protection device can be obtained.

Follow the procedure below to set up IO on the APP. Set up and configure the

functions of IO. The current functions supported by IO include (related to visual protection): **primary reduced mode, secondary reduced mode, protective stop.** The reduced mode supports the setting of reduction ratio. If the reduced mode takes effect during operation, the robot will reduce the speed according to the reduction ratio based on the initial speed of program operation. Normally, the numeric value set for the primary reduction ratio should be higher than the numeric value set for the secondary reduction ratio. User can select the function mode of the two IOs and set them according to the actual needs. As shown in Figure 5.3, IO functions can be modified and configured.

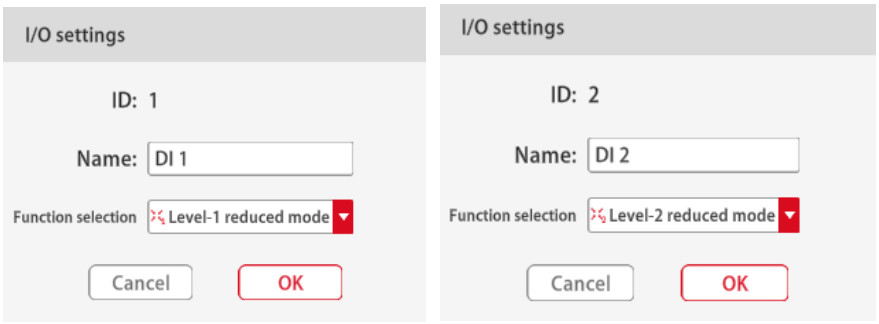


Figure 5.3 DI Function Setting Diagram

The reduction ratio can be set under [Settings] – [Safety Settings] – [Protection System] – [Parameter setting], as shown in Figure 5.4.

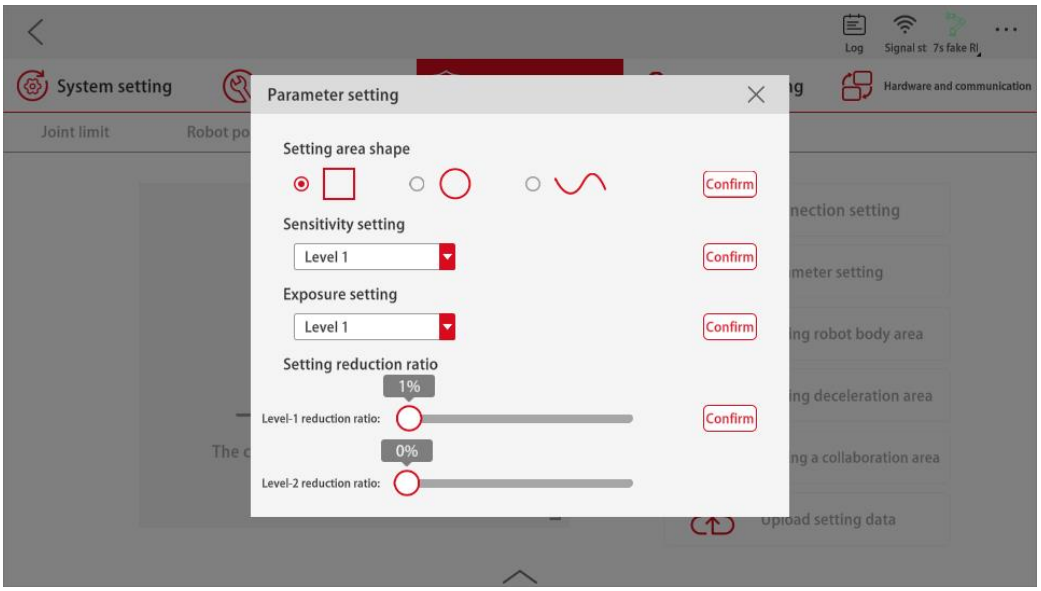


Figure 5.4 Reduction Ratio Settings

5.3 Camera Web Interface

Open the browser and enter the IP address of the camera (enter 192.168.1.128 by default) to access the Web login page of the device. The browser is required to support HTML5. Google Chrome and Firefox are recommended.

After entering the webpage, it is necessary to create a project. Select [New] under [Project] in the left menu bar, and select [General AI] in the icon area, as shown in Figure 5.5.

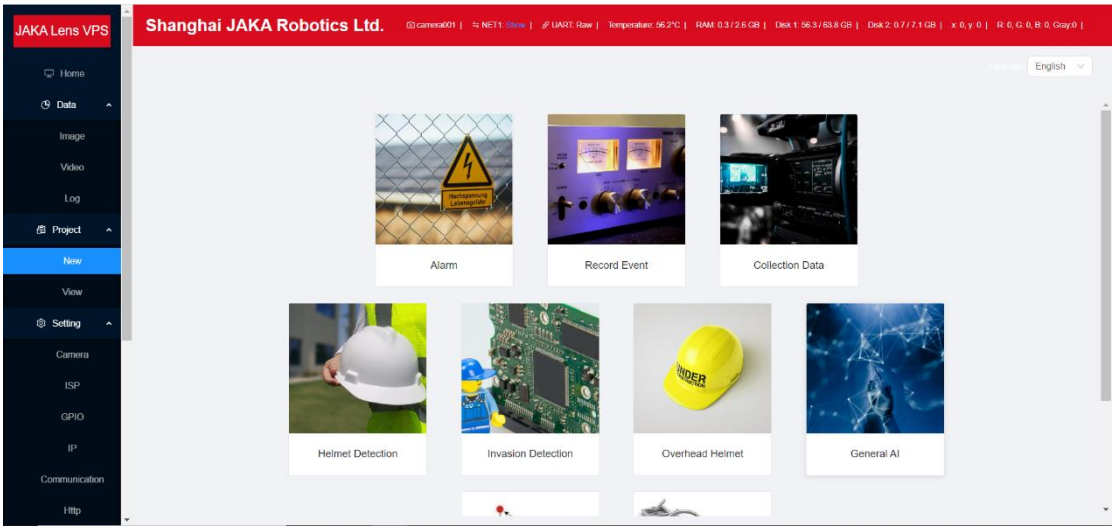


Figure 5.5 New Program

The new project is established in three steps:

Step1: Name the program, as shown in Figure 5.6.

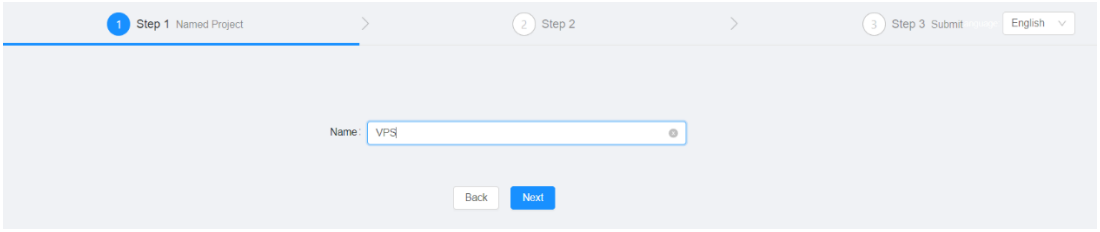


Figure 5.6 Program Naming

Step2: Parameter settings which can draw the recognition area, set the recognition threshold, save images and videos, etc. Click the "Preview" button to see the current image in real time, as shown in Figure 5.7. Of which:

Model selection: select the recognition model, the true class selects the object to be detected and the false class selects the object not to be detected.

Identification area: it can be set as whole and partial;

Number of roi: Multiple roi regions can be drawn for local areas (The maximum number of roi is 10), as shown in Figure 5.8

Detection strategy: recognition frame into the recognition area detection mode, AnyPix: recognition frame any point into the recognition area to initiate an alarm; Center: recognition frame center point into the recognition area to initiate an alarm; BottomCenter: recognition frame bottom line center into the recognition area to initiate an alarm.

Detection threshold: When judging a single photo, the system judges that if the confidence coefficient of the detected target is greater than the set threshold, the judgment is true and vice versa. When the set threshold is larger, the accuracy is high but easily undetected; when the set threshold is smaller, the accuracy is lower and easily false detected.

Number of statistics: assessment using the last N results.

Percentage threshold: the percentage of the number of true evaluation results among the last N evaluation results to the total evaluation results, and the final judgment result is true if this threshold is exceeded. When the set threshold is larger, the accuracy is high but easily undetected; when the set threshold is smaller, the accuracy is lower and easily false detected.

Working mode: background loop and trigger execution.

Execution mode: count execution, flip execution and trigger execution.

Interval time: refers to the detection interval time.

Capture: switch the button to save the image to the camera, either when no target is detected or when a target is detected.

Recording: Choose from two options: when no target is detected or when a target is detected. When you choose to record, you need to set the duration of the recording, where before (seconds) represents the screen in the N seconds before the start of the recording; after (seconds) represents the screen in the N seconds after

the start of the recording. As shown in Figure 5.7.

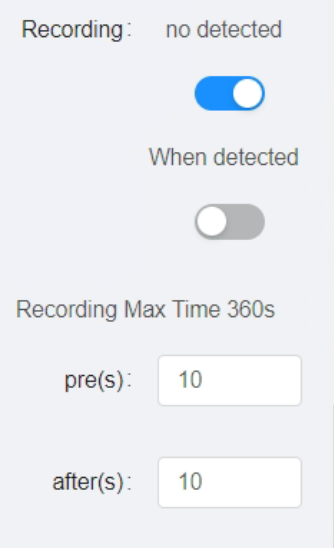


Figure 5.7 Video settings

Report: optionally when no target is detected or when a target is detected (Note: can be viewed in the log management.)

Image saving: both in-camera storage and FTP storage.

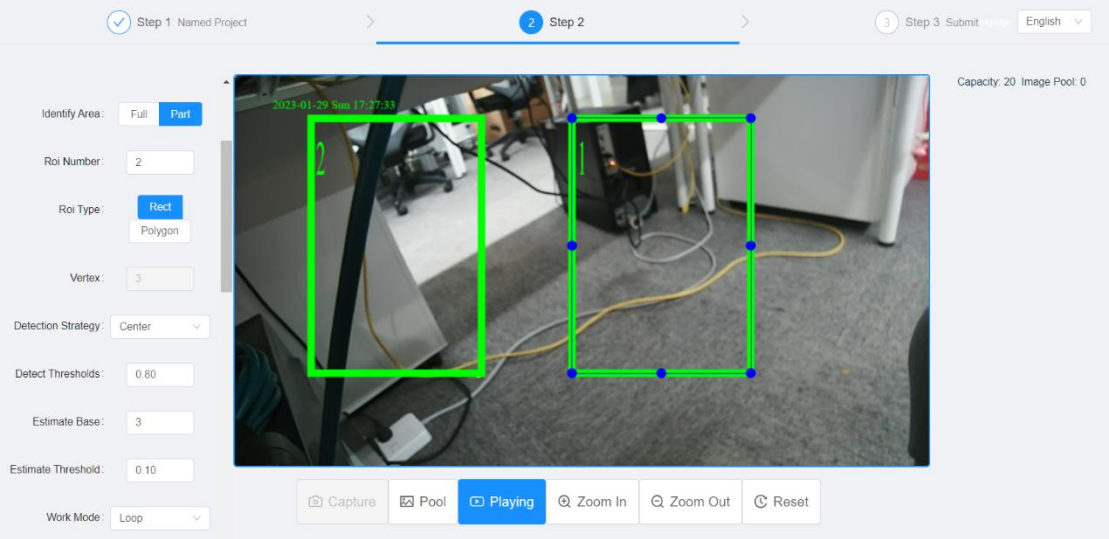


Figure 5.8 Drawing the roi region

Step3: Submit. Selecting IO as the result output, as shown in Figure 5.9. **The duration of IO set here needs to be longer, no less than 100ms. Otherwise, it can cause confusion in robot IO reception.** The IO output can be achieved by corresponding ROI.1 to GPO1 and ROI.2 to GPO2, as shown in Figure 5.10.

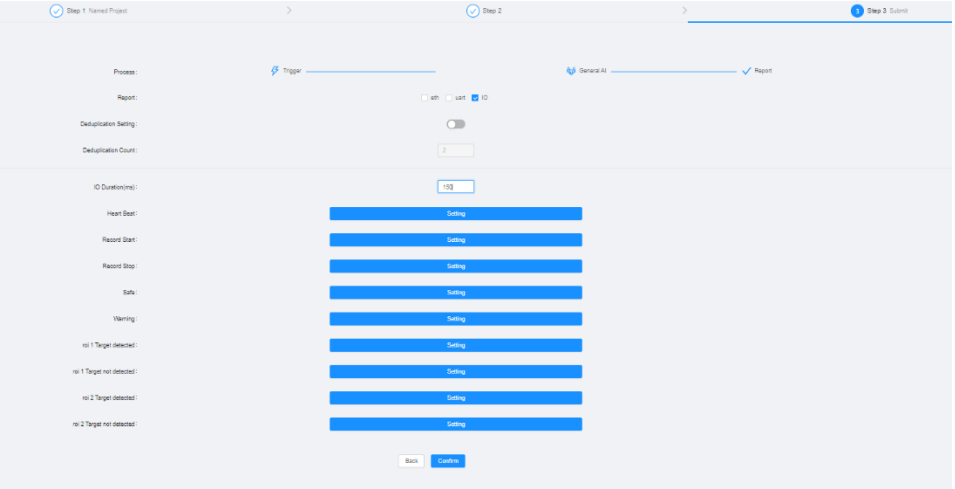


Figure 5.9 Submission Screen

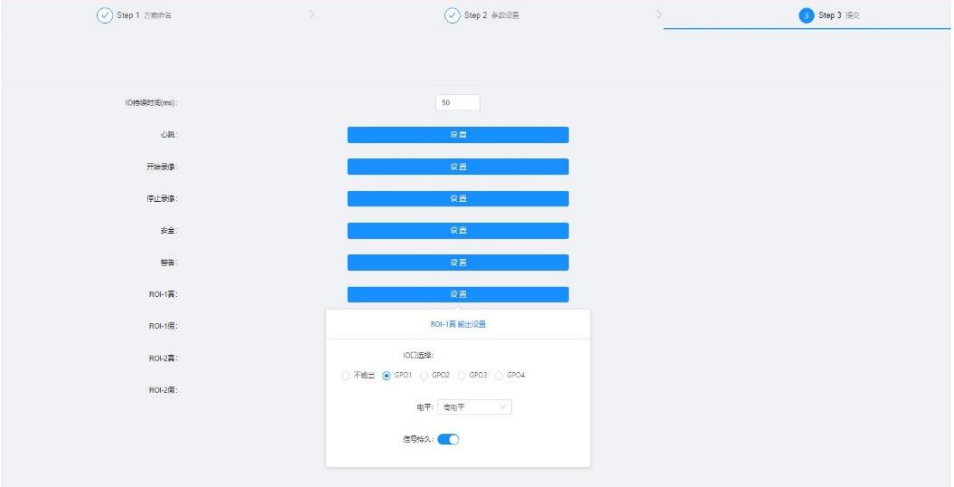


Figure 6.10 IO Output Settings

Once the new project is complete, start up the edited project in [View], as shown in Figure 5.11.

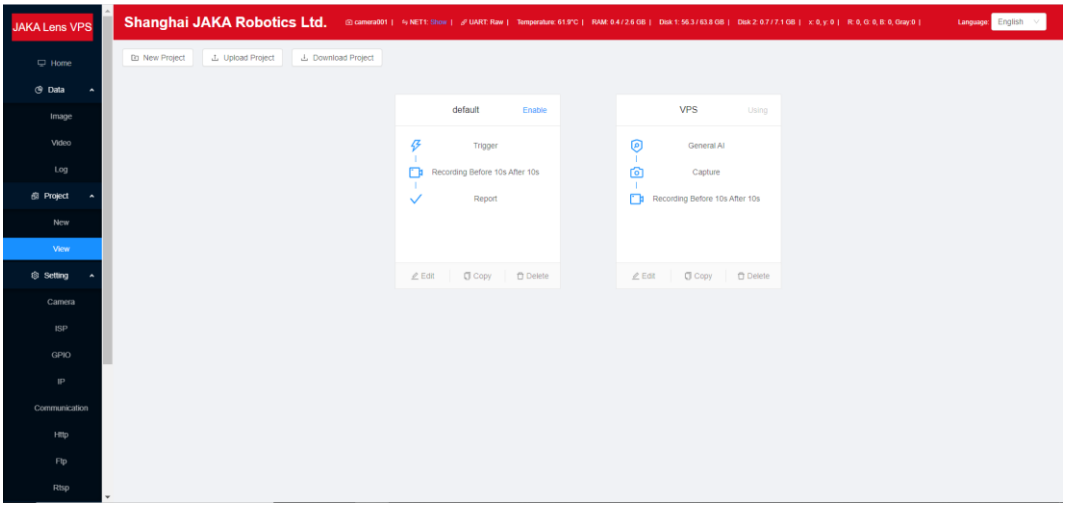


Figure 5.11 Start Up Project

Once the final enabled project is complete, the results of the test can be seen by running the program on the main interface, as shown in Figure 5.12.

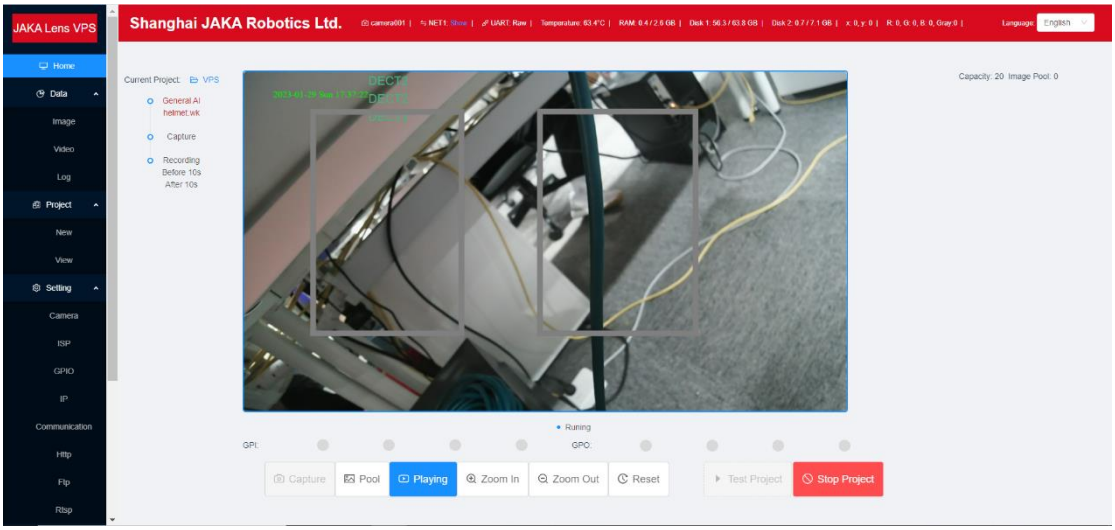


Figure 5.12 Test results

Attention

1. **Cable cannot be plugged in**

The camera cable has a fool-proof design, and failure to insert the cable after repeated rotations indicates that the port is incorrect.

2. **Setup tool cannot connect to camera**

Check whether the network cable is properly plugged in, check the network settings of the computer running this tool, and check the factory default IP of the camera is 192.168.1.128; subnet mask is 255.255.255.0. The computer needs to ensure that it is in the same network segment as the camera, i.e. 192.168.1.xxx. For example: the IP address is set to 192.168.1.3 with a subnet mask of 255.255.255.0. When manually setting the computer IP address, please set the last digit between 2 and 254 (including 2 and 254). At the same time, the IP address cannot conflict with the IP addresses of other devices under the network segment. That is, it cannot be the same as their IP addresses. The above situation shall not be considered when router is used. The router will automatically assign an IP address to the computer.

3. **When the laptop is connected to the camera, if cannot PING and open the Web**

Try turning off the wireless NIC and try again.

4. **Unable to add project**

Check if a project with the same name already exists.

5. **Unable to delete project**

Check if only one project exists. It is not possible to delete a project when only one exists in the camera system.

6. **Setup tool cannot start properly**

Set the program to [compatibility mode startup]→[WindowsXP] in software properties.

7. **Browser fails to display properly or fails to play video**

IE and Edge browsers are not allowed on this web. Google and Firefox are recommended.

8. Mounting height of visual protection cameras

Theoretically, the higher the installation height of the visual protection device, the larger the protection area can be set. Therefore, **it is recommended that the visual protection device be mounted at an angle to the top of the robot. When the height is 2.5m from the ground, the protection area is approximately 5m*2.6m.**