August 2021

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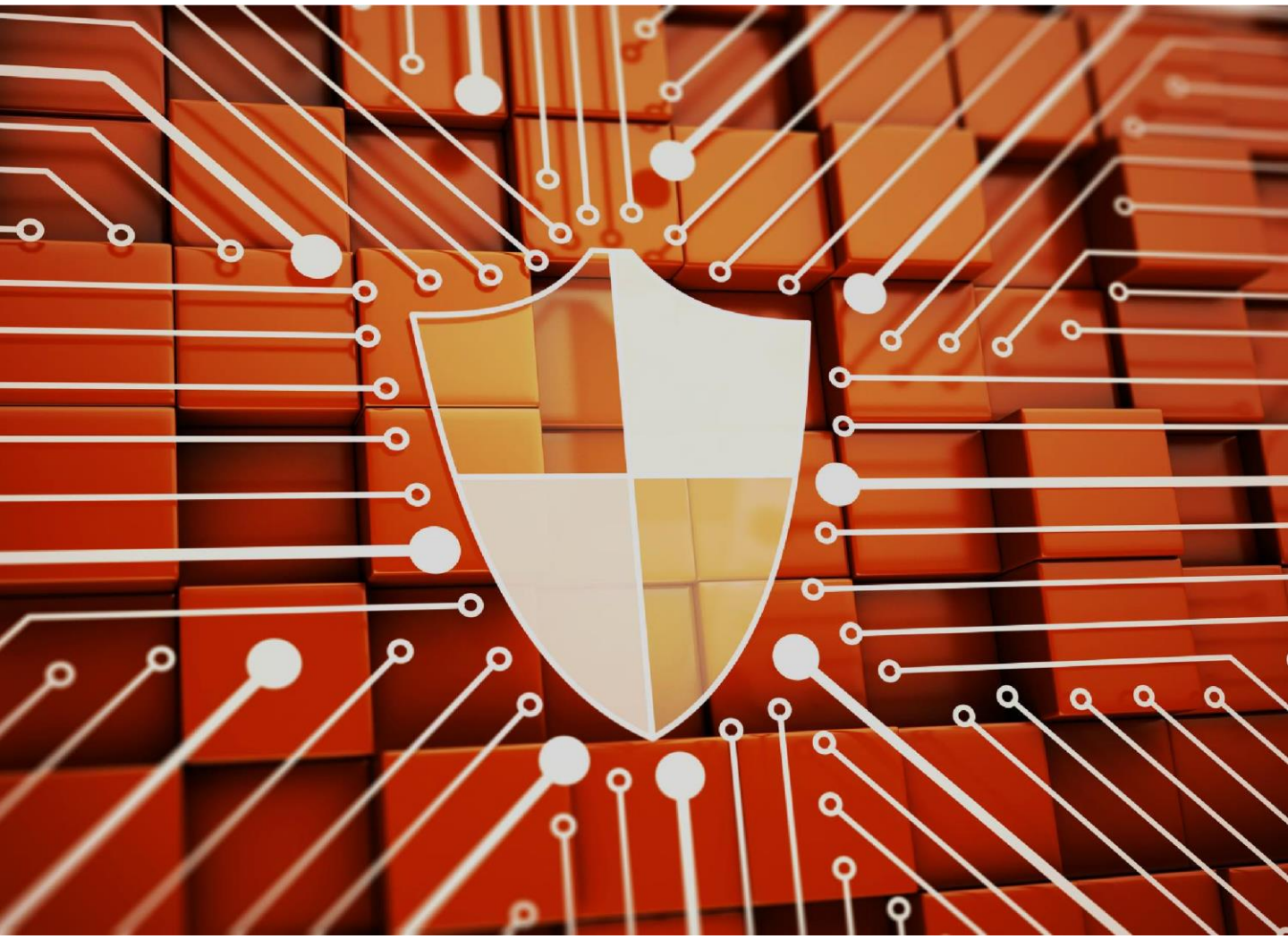
IRISHIELD™–USB SERIES

BASIC USER'S GUIDE FOR

WINDOWS



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Document
Change Record

This page records any updates and revisions to the IriShield™-USB series Basic User's Guide.

Doc ver.	Date	Change Description	SDK ver
0.9	01st Aug 2012	1st beta release	2.0.1
1.0	07th Nov 2012	2nd beta release, update new SDK	3.0.0
1.1	16th Nov 2012	Minor changes	3.0.0
1.2	19th Nov 2012	Update IriSmartEye2000 v2.2.0_build433	3.0.0
1.3	21st Nov 2012	Update system management, grammar correction	3.0.0
1.4	18th Jan 2013	Update system management	3.0.0
1.5	29th Aug 2013	Update the new GUI of IriSmartEye2000	3.2.7
1.6	24th Oct 2013	Update product inventory and format	3.2.7
1.7	27th June 2014	Update the new GUI of IriSmartEye2000 and Power Management function	3.3.0
1.8	31st Jul 2014	Minor update on System Management function	3.3.0
1.9	17th Apr 2015	Include all IriShieldTM-USB models	3.3.0

Note

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IriTech reserves the right to make changes on this hardware and software with the intent to improve its functionalities. Information and specifications contained in this document are subject to change without prior notice and do not represent a commitment on part of IriTech.

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1. Preface

1.1 Purpose of this Document

The Basic User's Guide explains how to install software package and conduct simple demonstrations of an IriShield™-USB camera using a PC and the included IriSmartEye2000 application on Windows operating system. It includes guidance on the best way to optimize the equipment, reviews the capture process, performs iris recognition tasks, does system management and suggests how to maximize the quality of iris images as well as matching accuracy.

1.2 Intended Reader

This document is written for a broad audience, ranging from business managers, sales personnel, to engineers. Readers of this manual are assumed to have little knowledge of electronics or software. There is no presumed knowledge about any aspect of IriShield™-USB or the field of biometrics.

1.3 Other Documentation

For additional information about this product, refer to the following documents:

- IriShield™-USB and IriShield™-UART SW Developer's Manual – useful tips for IriShieldTM SDK development
- IDDK 2000 API Reference Manual for C_C++ – reference of IriShield™ API
- IriShield™-USB MK 2120U HW Developer's Manual – detailed technical overview of the MK 2120U hardware to assist in product integration
- IriShield™-USB MO 2120 HW Developer's Manual – detailed technical overview of the MO 2120 hardware to assist in product integration
- IriShield™-USB MO 2121 HW Developer's Manual – detailed technical overview of the MO 2121 hardware to assist in product integration
- IriShield™-USB BK 2121U HW Developer's Manual – detailed technical overview of the BK 2121U hardware to assist in product integration
- IriShield™-USB BO 2121 HW Developer's Manual – detailed technical overview of the BO 2121 hardware to assist in product integration

1.4 Contact Information

If you have any questions or experience any problems using this hardware, please contact:

Phone: +1.703.877.2135 (USA)
+82.2.872.3812 (South Korea)

Email: collaboration@iritech.com

Your feedback is important for us to help and provide you with the most accurate and highest quality information. If you have any comments about this documentation, please email us. Include the version of this document and the section that pertains to your comments.

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2. Introduction

IriShield™-USB series camera hardware is a revolutionary, monocular design that delivers the highest quality auto-capturing iris acquisition with an ease of use never achieved by older camera systems. The system offers contactless, fast, standards-compliant iris acquisition in a small form factor that is easy to house in a variety of packages. IriShield™-USB includes an embedded CPU that enables on-board computing for automated quality-based iris image capturing, recognition, and verification without taxing the computing power of the host PC. IriShield™-USB provides a PKI-based security infrastructure which creates a self-generated RSA-2048bit key and generates a random one-time AES256bit key for each session. As a result, this camera can operate with nearly any host PC or mobile computing device. With its USB interface, compact design, and sophisticated, easy-to-integrate accompanying software, IriShield™-USB represents unprecedented value for iris biometrics identification.

3. Item Inventory

Note: Inventory of an IriShield-USB model is different from others, please refer to the Hardware Manual of a specific model for the full information.

You will need the following items to operate the IriShield™-USB in demonstration mode:

- Hardware Package is different from each model. But usually, it includes:
    - IriShield™-USB camera unit o USB Cable
- Software Package containing:
    - IriShield™-USB Driver that establishes PC communication
    - IDDK 2000 Software Development Kit
    - IriSmartEye2000 Software for demonstration

(After purchasing IriShield™-USB camera, please contact IriTech <collaboration@iritech.com> to get accounts to download all software packages from IriTech's website).

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STANDARD

IriShield-USB MK 2120U

Pouch

Micro USB cable

Software Package

Figure 3-1 Product type package of IriShield™-USB MK 2120U

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STANDARD

IriShield™-USB BK 2121U

Goggle

USB cable

Software Package

Figure 3-2 Product type package of IriShield™-USB BK 2121U

4. Warnings and Precautions

4.1 Hardware

IriShield™-USB includes sensitive electronics and optics. It is possible for IriShield™-USB device to get these electronics damaged if you do not follow proper precautions:

- Clean regularly to remove dust, but do not use any cleaning solutions. Only wipe the device with a smooth cloth or towel. Keep the lens free of dust and dirt, and use a special cloth for optics in order to avoid scratching the optics.
- Do not allow water to leak into the device or operate the device in humid conditions where water might condense upon the electronics.
- Do not operate device in places where temperature reach extremes beyond the stated range.
- Do not place the device next to heating equipment.
- Do not place magnets near the device.
- Do not apply voltage or current beyond the stated range.
- Do not use the device for any purposes beyond those specified.
- Do not disassemble components from the boards or alter wiring or board design.
- Do not drop the device or submit to sudden impact or mechanical stresses.

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- Handle the electronics with proper anti-static protection and techniques to prevent shorting any microchips.

Any damage to the device caused by these activities will void the warranty.

This document describes guidance to install Software Package including SDK, Driver and IriSmartEye2000 application. It also guides how to use IriShield™-USB device with IriSmartEye2000 application in the most proper way. If user does not follow the guideline, errors or wrong results may occur.

4.2 Software

To prevent faulty matching, the following guidelines should be considered carefully by developers. Please be warned that the threshold numbers given in this section are only for reference. Developers should have their own decisions to balance between accuracy and usability based on their iris database.

4.2.1 Enrollment

- ***Image quality***: Total score and usable area should be greater than 70 (>70), the captured image is ideal for enrollment. If either total score or usable area is less than or equal to 50 (<=50), the image should be rejected.
- ***Horizontal rotation***: For enrollment, horizontal rotation angle of eye postures should not exceed ±10 degrees.
- ***Deduplication***: Before enrolling a template, make sure the template does not match with other enrollees'. Deduplication can be done automatically by device or manually by developers.

4.2.2 Matching

- ***Image quality***: Total score and usable area should be greater than 30 (>30). Otherwise, the image should NOT be used for matching.
- ***Horizontal rotation***: For matching, horizontal rotation angle of eye postures should not exceed ±20 degrees.
- ***Matching decision***: The decisive distance value is the smallest distance among those returned from 1:1 and 1:N comparisons. If the distance is smaller than or equal to the genuine threshold, a positive match is claimed. If the distance is greater than the imposter threshold, the query image is from an imposter. Otherwise (i.e., the distance is greater than the genuine threshold and smaller than or equal to the imposter threshold), there is some uncertainty due to, e.g., low image quality, occlusion, or pupil dilation, and the user should have his/her iris image recaptured with an eye wide opened and do the matching again.

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5. Operating Conditions

5.1 Minimum System Requirements

IriShield™-USB is an onboard-processing camera, therefore it has no special requirement for host device except USB 2.0 port. However, there are some hardware requirements to run IriSmartEye2000 software.

- Windows XP (Professional edition) SP2/3, Window 7, or Windows 8
  (Please refer to IriShield™-USB and IriShield™-UART SW Developer's Manual for other operating systems)
- Processor speed of 1 GHz or higher
- RAM: 128 MB or higher
- HDD: 500 MB free hard disk space
- One USB 2.0 port

5.2 Lighting Conditions

IriShield™-USB can operate both indoors and outdoors, but special care should be taken to avoid strong sunlight that will degrade image quality. However, if the illumination power is not enough, the captured iris image may get "Red-eye" effect. IriTech recommends the IriShield™-USB device to be operated at illumination power of 700 lux.

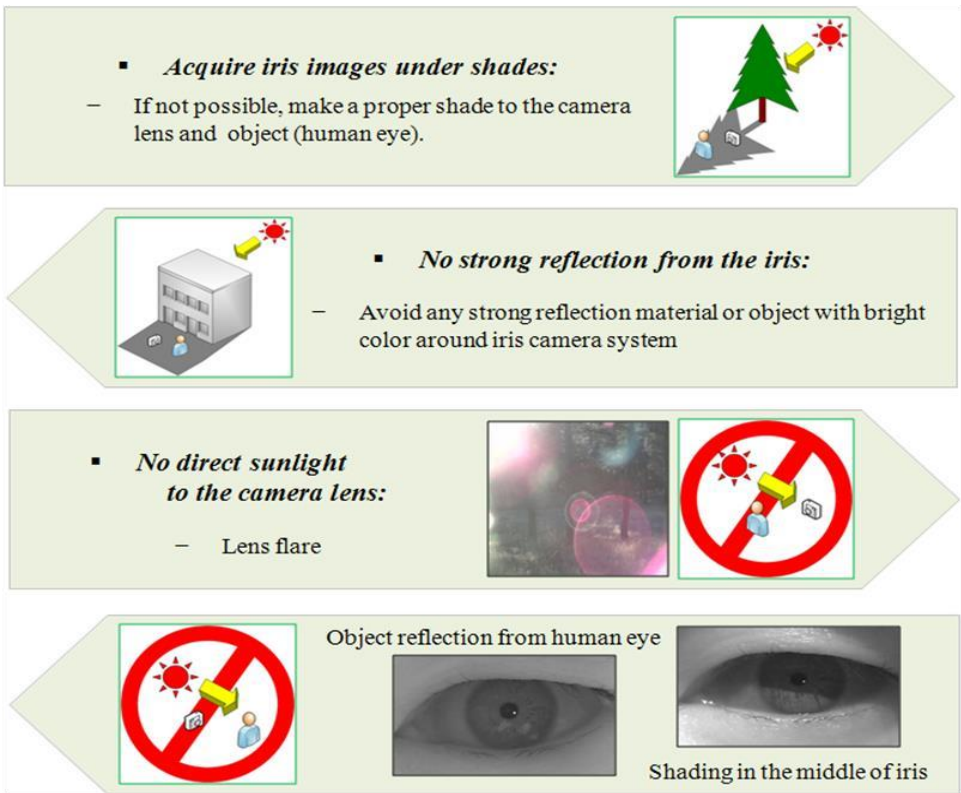

Figure 5-1 Effects of sunlight on iris image acquisition

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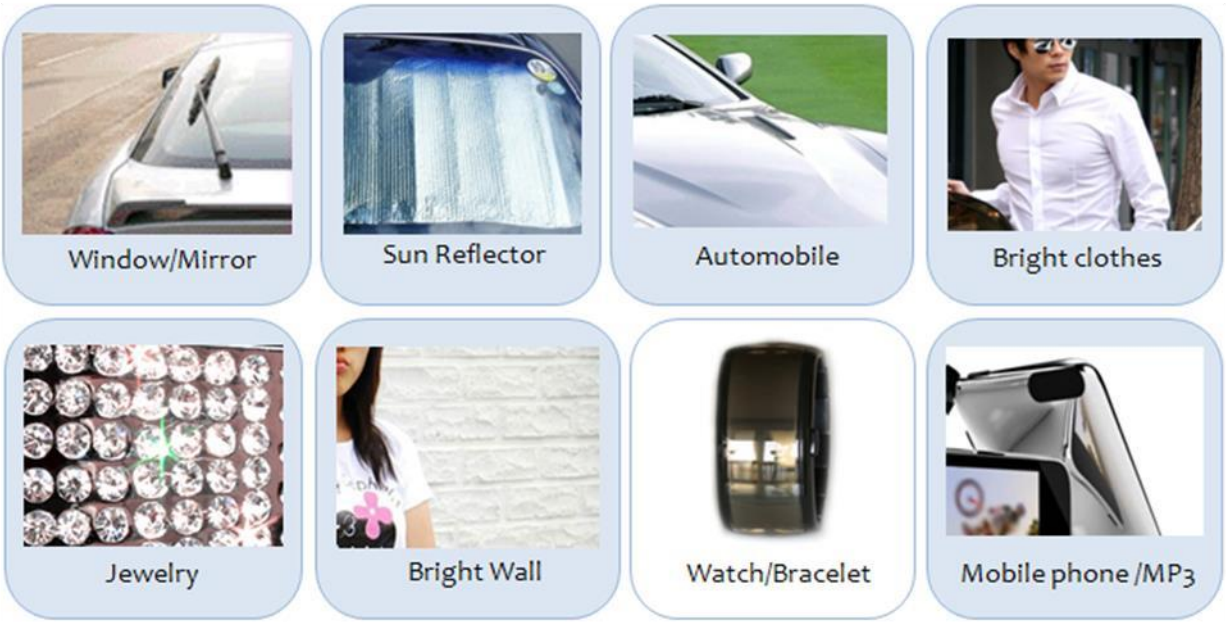

Figure 5-2 Materials that significantly reflect sunlight

If sunlight reflection is a problem, shade the user and the camera using the following methods:

Figure 5.3 Possible methods to reduce sunlight reflection

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6. Camera Operation

6.1 Lighting Conditions

Parameter	Focal Depth	Horizontal	Vertical
Range	0.6 cm (0.2 in)	3.3 ± 0.1 cm (1.3 in)	2.4 ± 0.1 cm (0.9 in)

Volume: 4.8 cm³ at 4.7 ~ 5.3 cm range

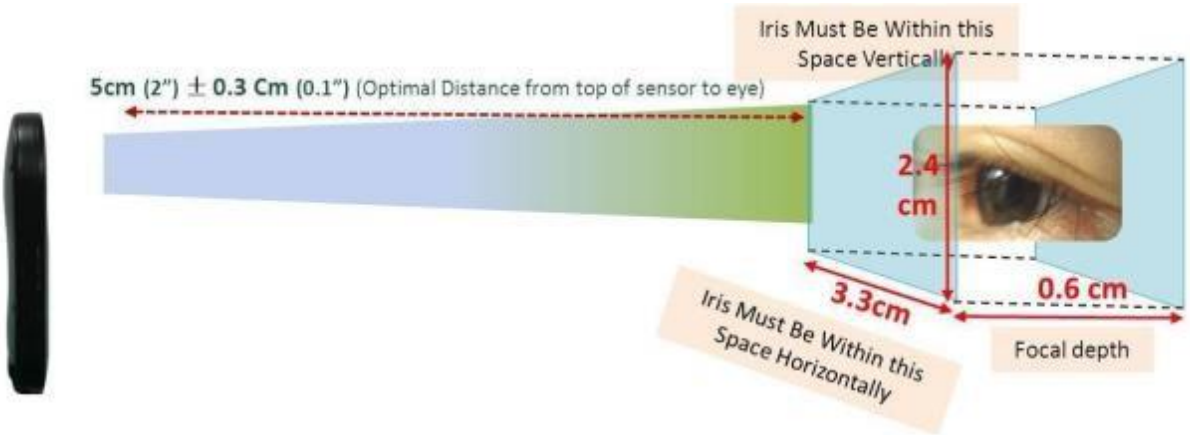

Figure 6-1 Capture volume of IriShield™-USB MK 2120U

The capture volume is defined as volume of a cube which is in focus of the camera. The captured iris image will have high quality if it is located in this cube.

Optimal capture distance and capture volume of all IriShield™-USB are listed in the following table.

Table 1 Optimal capture distance and capture volume of IriShield™-USB series

IriShield™-USB Model	Optimal Capture Distance	Capture Volume
MK 2120U / MO 2120	5 cm (2 in)	3.3 x 2.4 x 0.6 cm (1.3 x 0.9 x 0.2 in)
MO 2121	13.5 cm (5.3 in)	3.3 x 2.4 x 1 cm (1.3 x 0.9 x 0.4 in)
BK 2121U	14 cm (5.5 in)	3.3 x 2.4 x 1 cm (1.3 x 0.9 x 0.4 in)
BO 2121	14.5 cm (5.7 in)	3.3 x 2.4 x 1 cm (1.3 x 0.9 x 0.4 in)

6.2 Proper Orientation of the User

During the acquisition process, the user must be properly oriented to the camera. Otherwise, the image quality is not good enough to warrant accurate matching. Here are examples of good and bad orientation:

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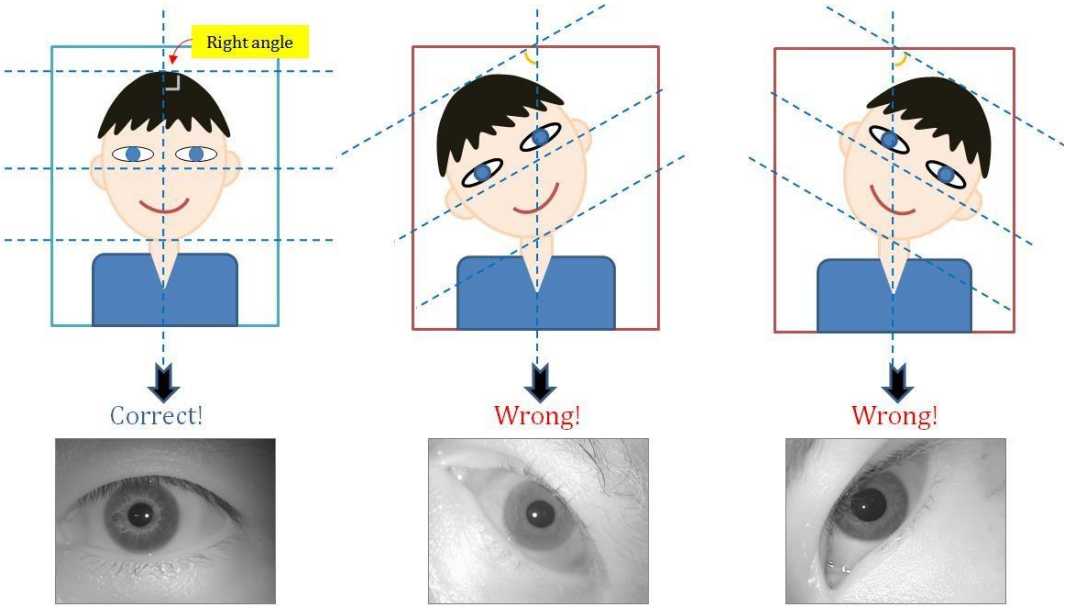

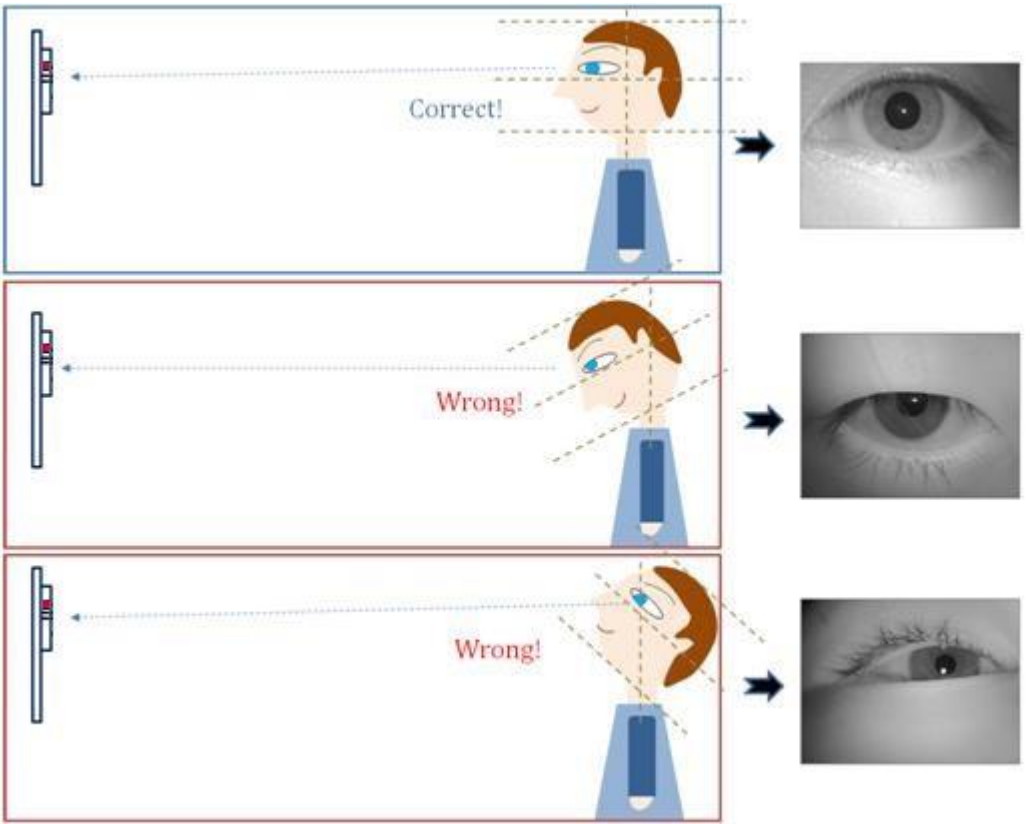

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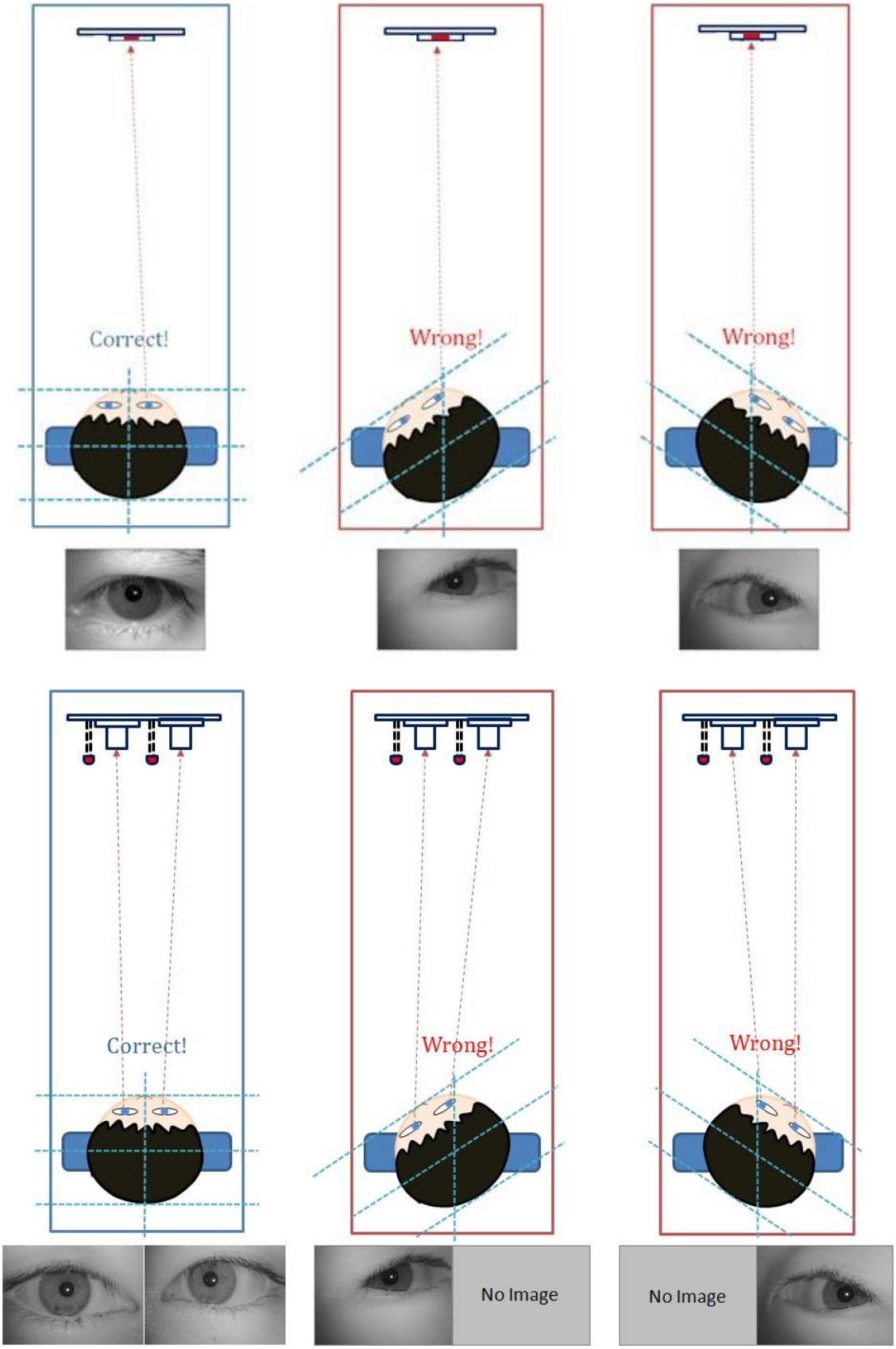

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7. Getting Started

7.1 Hardware Setup

- Connect one end of the USB cable into the IriShield™-USB camera, and
- Plug the other end of the USB cable into the PC's USB 2.0 port.

NOTE: Before the driver and software installation, you should have in your PC the IriShield software package downloaded from IriTech's website.

7.2 Driver Installation

The first time you plug the camera's USB cable into the PC, you must install the device driver in order to establish communication between the camera and the PC. Once the driver is installed properly, there should be no need to re-install the driver in the future.

Please follow these instructions to install IriShield driver on Windows XP and Windows 7 after you connect the device to the PC. The installation will be the same for the other Windows OS.

7.2.1 For MS Windows XP OS

1. The ***Found New Hardware Wizard*** should automatically appear as shown in the following step. If it does not appear, open the Device Manager (by clicking on Start > Control Panel > System > Hardware (Tab) > Device Manager). You will see a device with yellow mark as in below. Right-click **IriShield** (or **USB Device**) and select **Update Driver** as in below and the ***Found New Hardware Wizard*** will appear.

2. In the ***Found New Hardware Wizard***, choose "**No, not this time**," and then click "**Next**" to continue.

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3. Choose the second item, "**Install from a list or specific location (Advanced)**," and click "**Next.**"

4. Choose "**Search for the best driver in these locations**" and check "**Include this location in the search**". Click "**Browse**" and find the **"IriShield-USB Bino_Mono Driver"** folder in the software package. Click "**OK**" and "**Next**".

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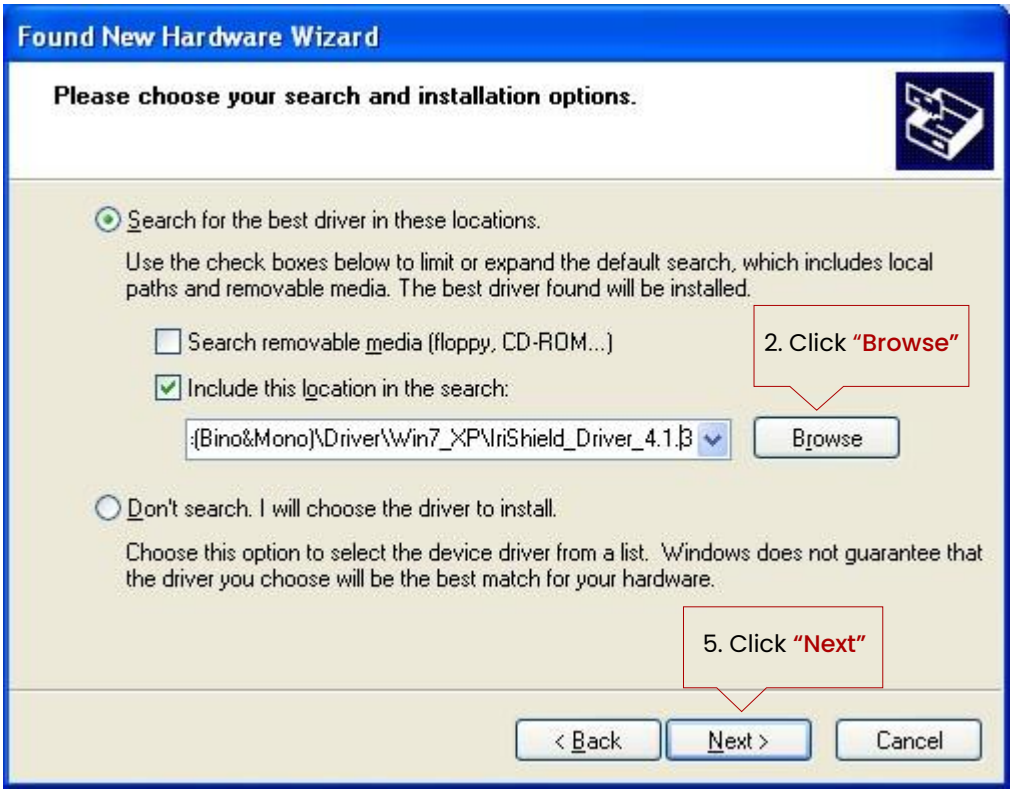

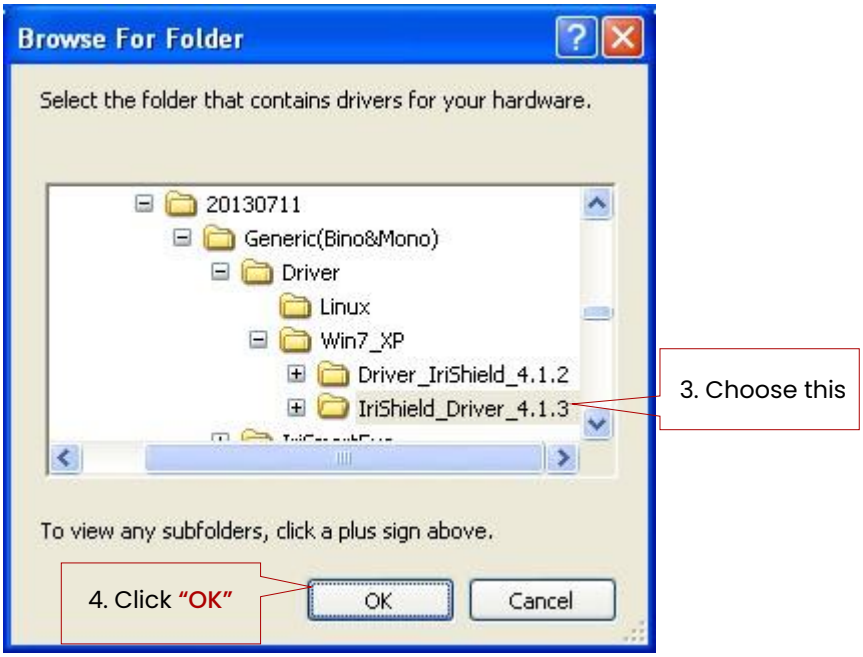

5. The wizard will install the driver using the files from the "**IriShield-USB Bino_Mono Driver**" folder.

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6. Once the driver is installed, the below window will appear. Click "**Finish**."

7. If you open the Device Manager, you will see that the yellow mark next to the device name has disappeared, as shown below, indicating that the driver has been installed properly.

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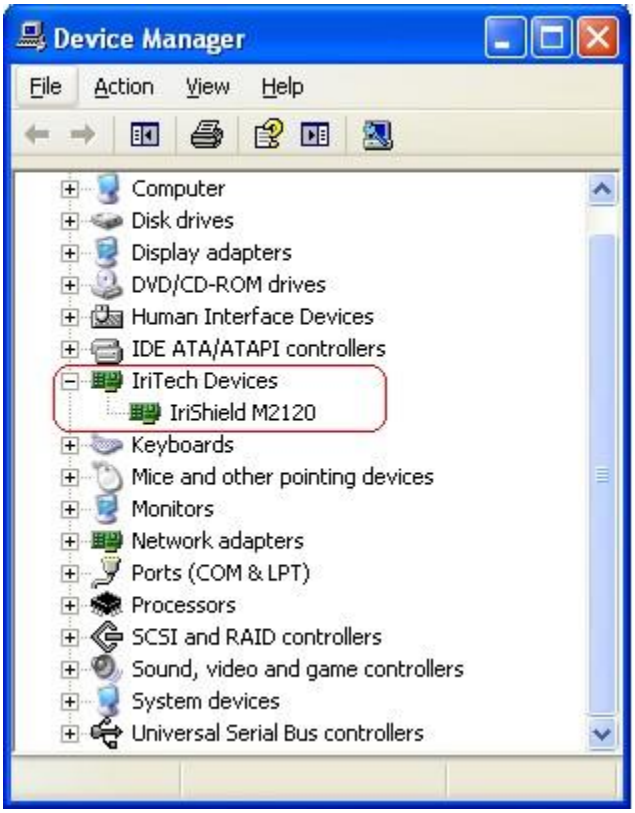

7.2.2 For MS Windows 7 OS

1. Open the Device Manager using one of the following directions:

- **Direction #1**: Click the Windows "**Start**" button and type "**devmgmt.msc**" in the Search box.
- **Direction #2**: Right-click on the "**My Computer**" icon on the Windows Desktop and choose "**Properties**". Then, click "**Device Manager**" on the left side of the window, located at the top of the list under "**Control Panel Home**."

You will see a device with a yellow mark as in below. Right-click "**IriShield**", then choose "**Update Driver Software…**"

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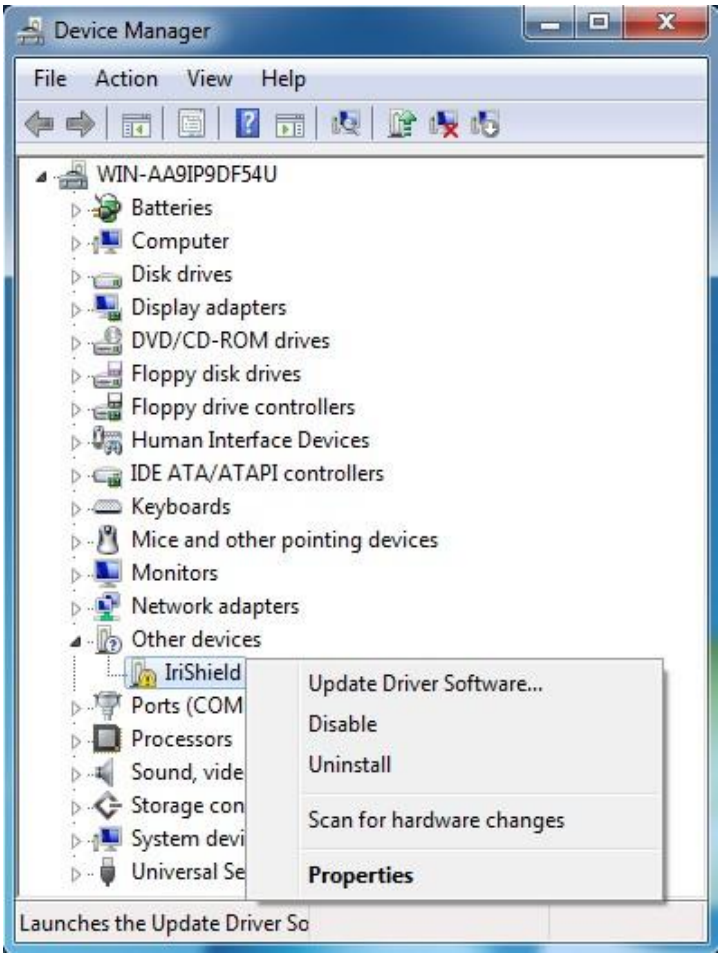
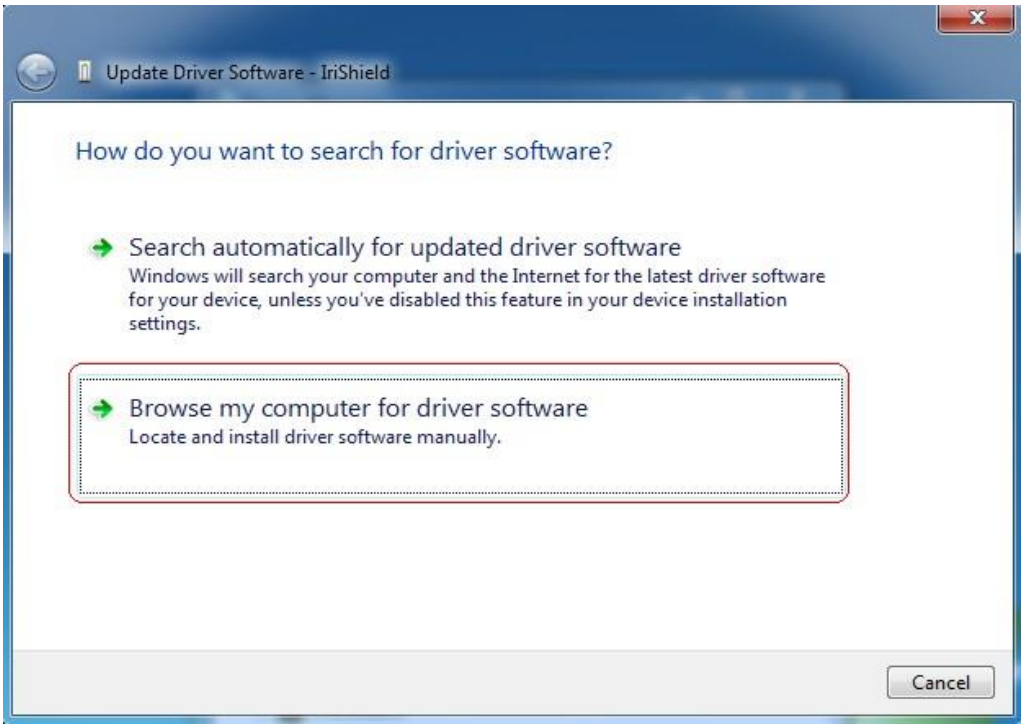


2. Choose "**Browse my computer for driver software.**"



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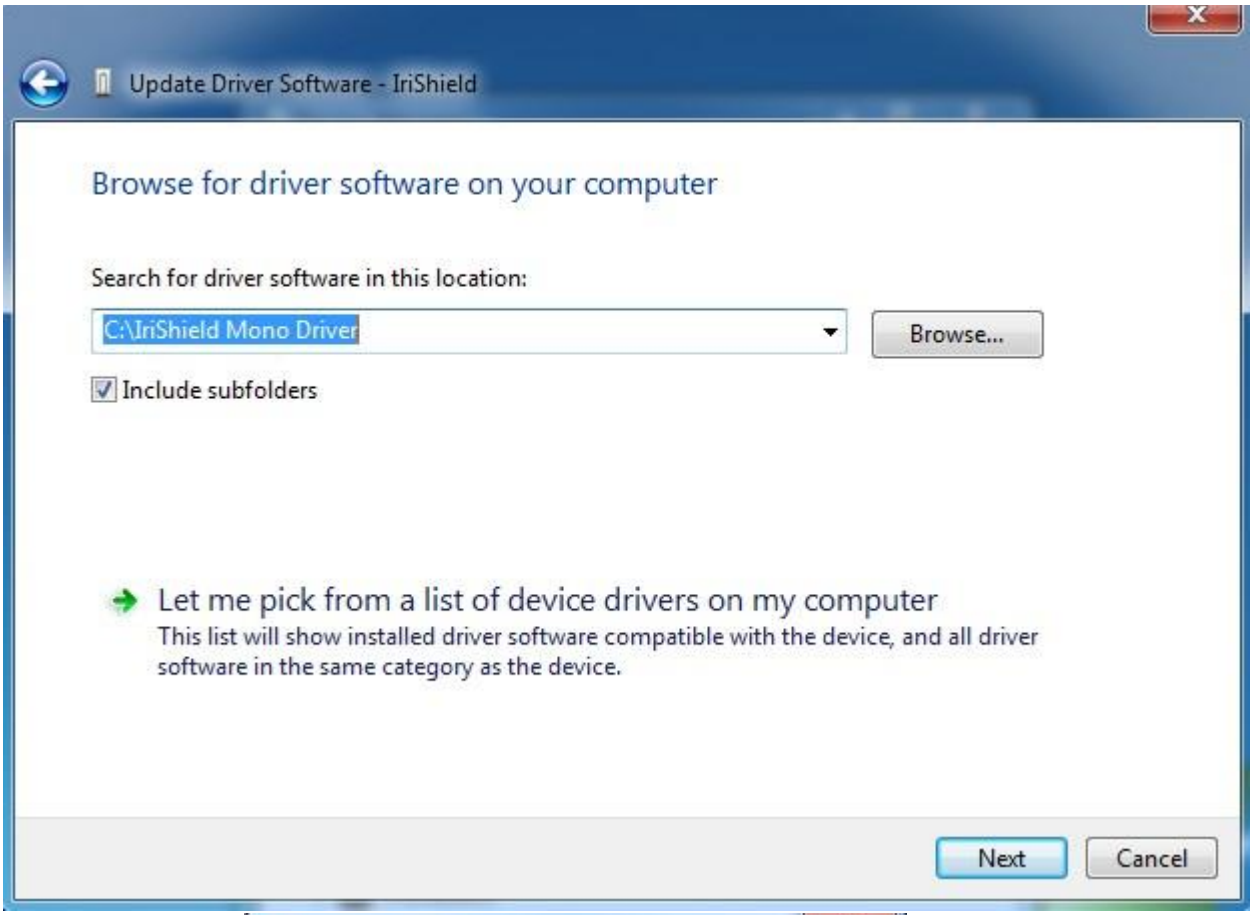
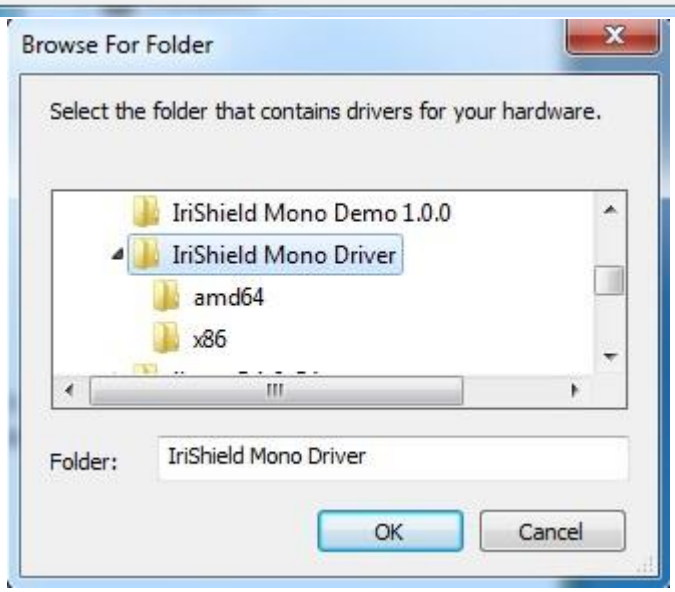
3. Click "**Browse**" and find the "**IriShield-USB Bino_Mono Driver**" folder on the software package. Click "**Next.**" (The correct driver should be chosen depending on the operation system.)





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4. The Windows Security window appears. Select **Always trust software from "IriTech, Inc."** and Click "**Install**" to continue.

5. Once the driver is installed successfully, the below window will appear. Click **"Close."**

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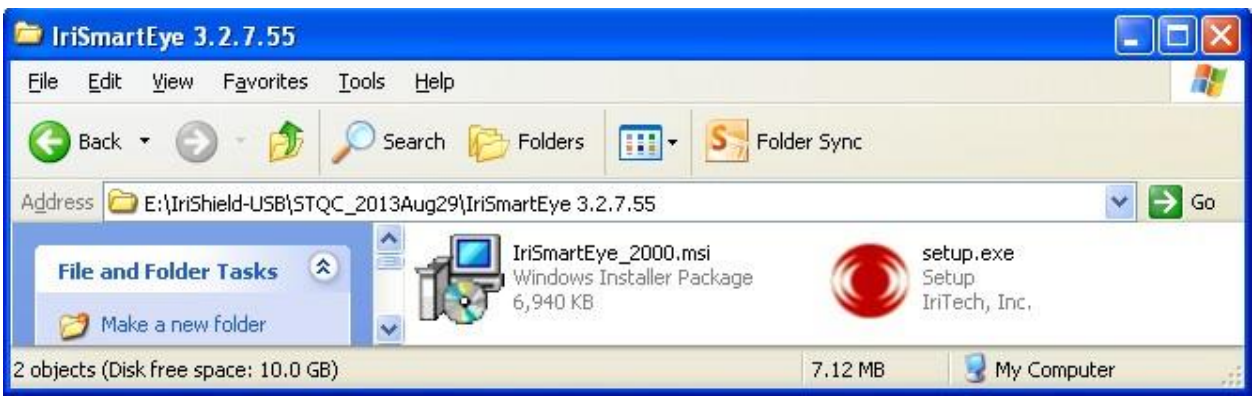
6. If you open the Device Manager, you will see that the yellow mark next to the device name has disappeared, as shown below, indicating that the driver has been installed properly.

7.3 IriSmartEye2000 Installation

The IriSmartEye2000 Program is software demonstrating how IriShield™-USB camera works. Please follow the instructions below to install this software on Windows XP (Installation on other OS is the same).

Note: The IriSmartEye2000 software version in the screen may differ from yours. The software version is subject to change without notice.

1. In the "IriSmartEye2000" folder in the software package, double click the **"setup.exe"** file. ("C:\IriSmartEye2000" - The setup folder name can be different from various versions.)



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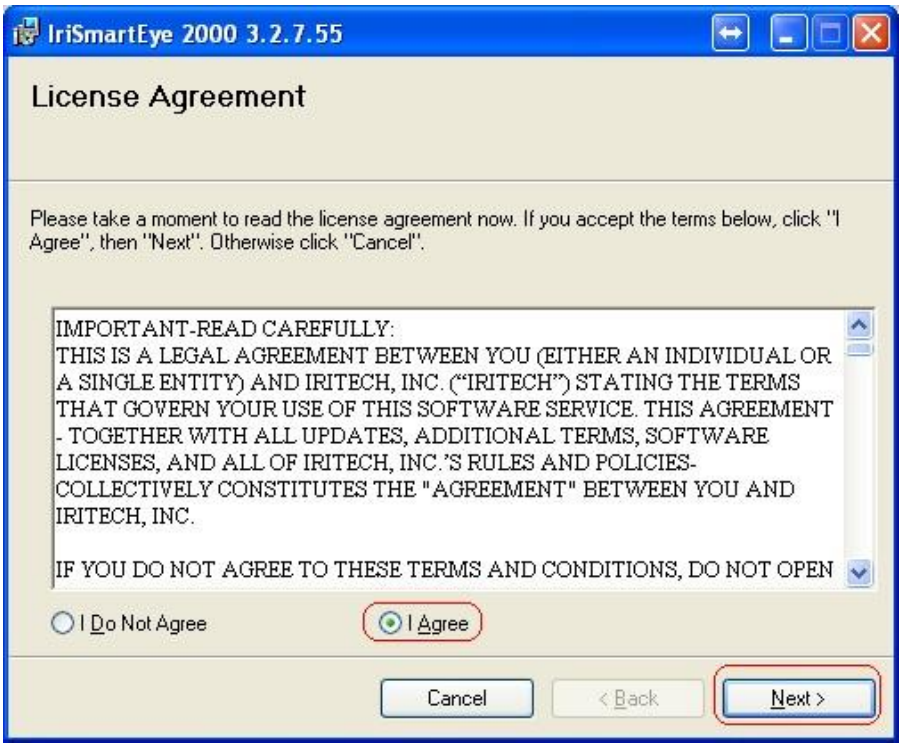
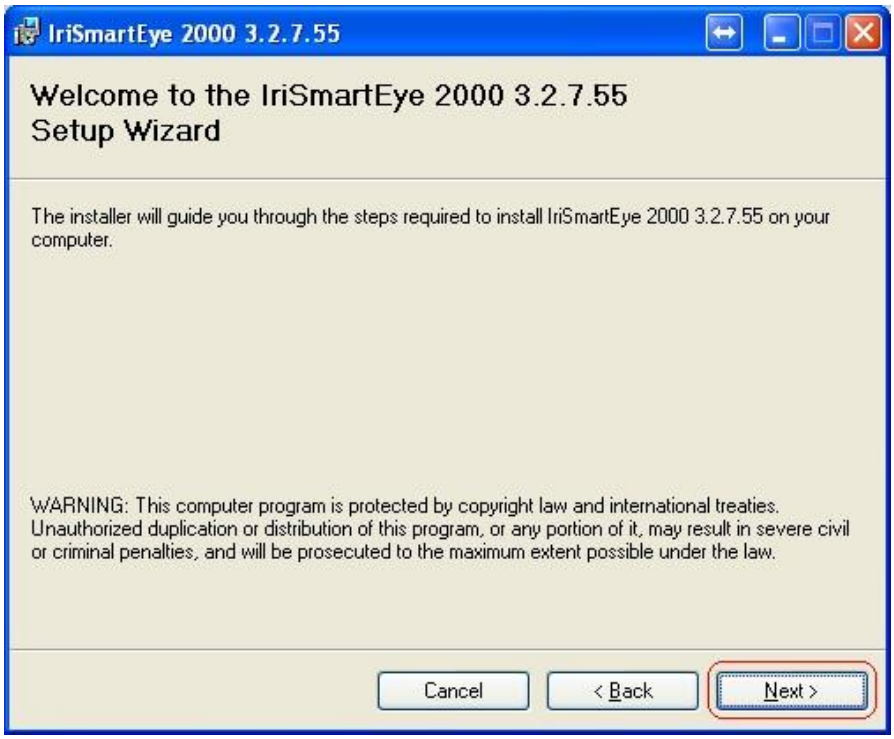
2. Read the license agreement terms carefully, select "**I Agree**," then click "**Next**".



3. The Setup Wizard will appear. Click "**Next**" for setup.



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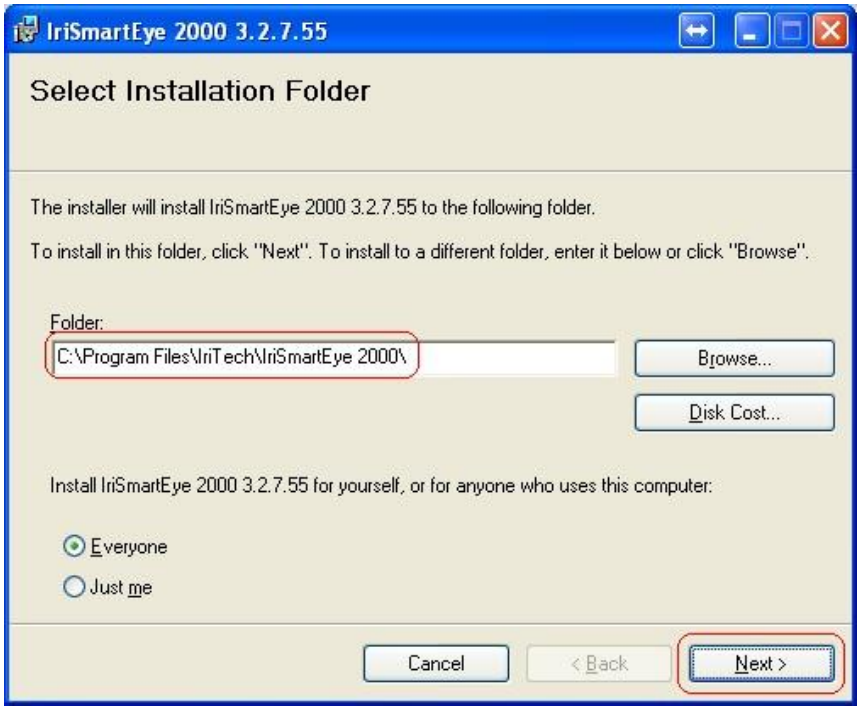
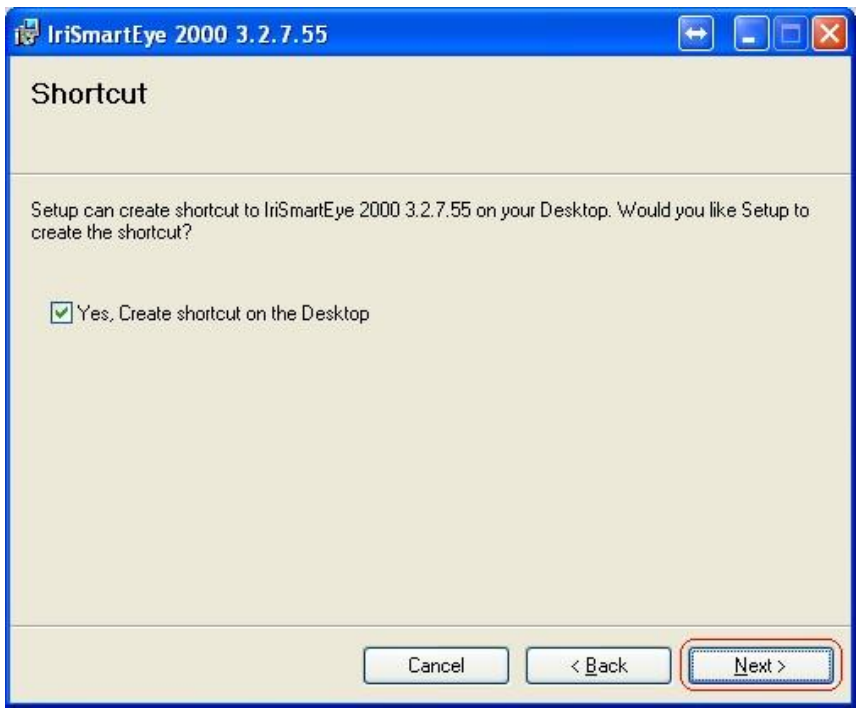
4. If you want to install this program in a different folder, click **"Browse"** and specify the desired folder. Click **"Next"** to continue with the default or selected destination folder.



5. Select option **"Yes, Create shortcut on the Desktop"**, then click **"Next"** to continue.



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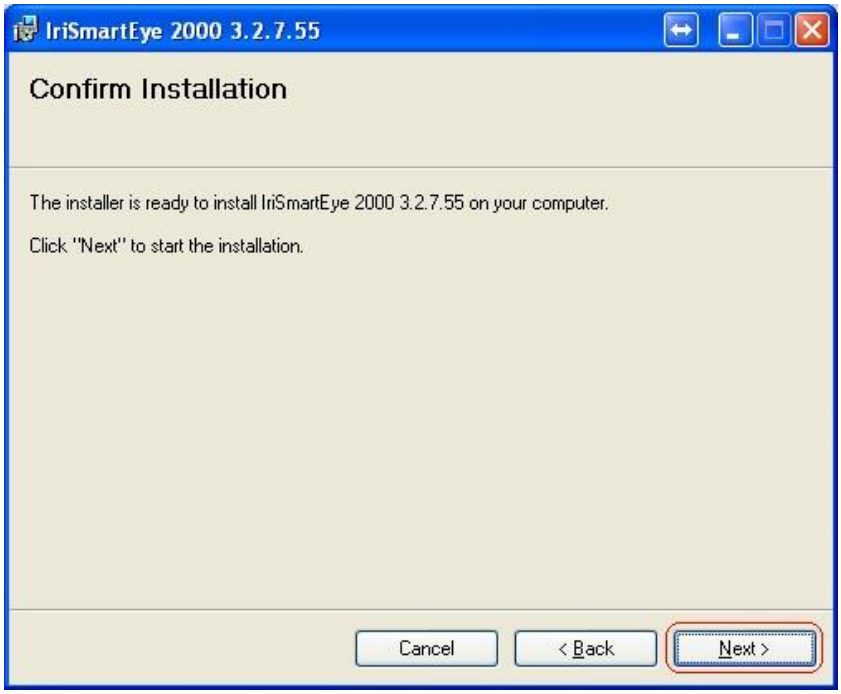
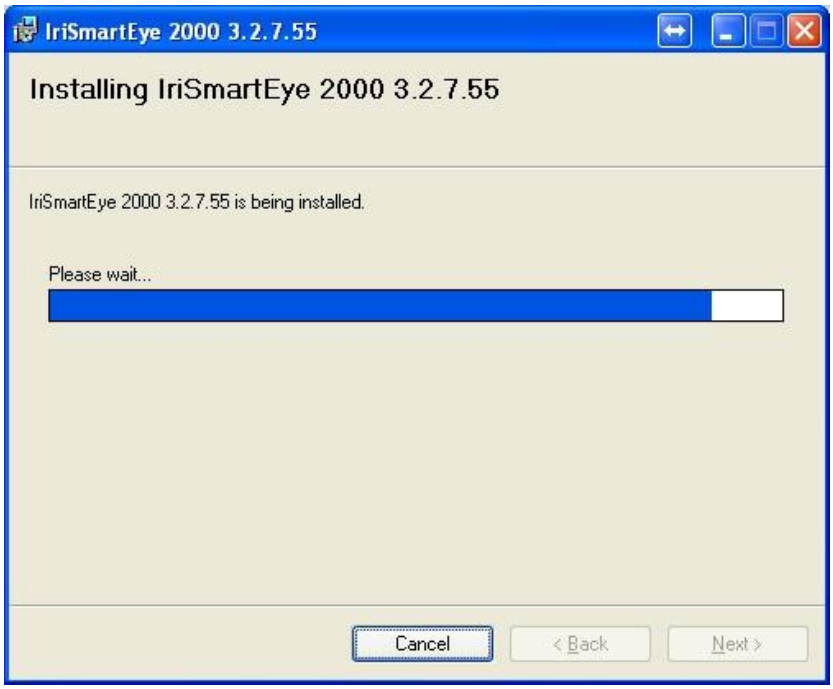
6. If you clicked "**Next**" on the confirmation window, the IriSmartEye2000 application will start to be installed.



7. Wait for the installation process to be complete, then click "**Close.**"



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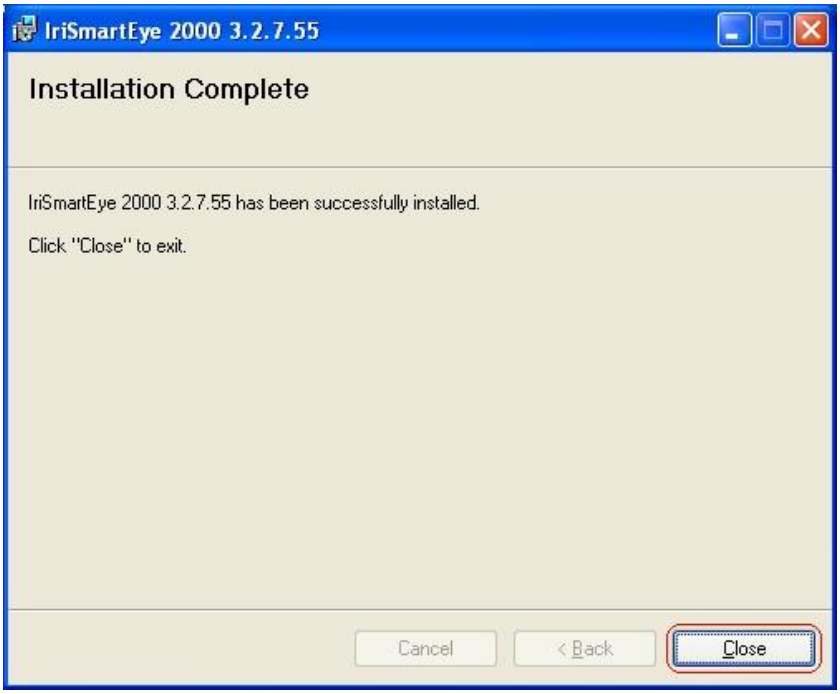
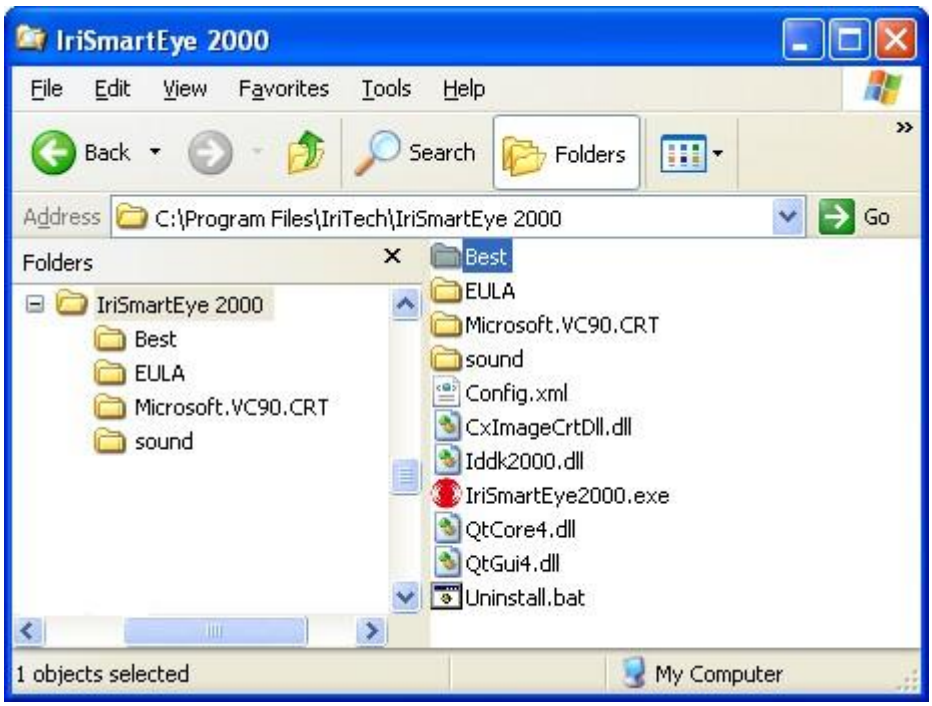


8. You can verify whether the program is properly installed by examining the selected destination folder on your computer.
("C:\Program Files\IriTech\IriSmartEye2000" - The folder name may be different for each version.)



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8. IriSmartEye2000 Software

The following demonstration for IriSmartEye2000 is performed on Windows XP as an example. The process on other operating systems can be executed exactly the same way.

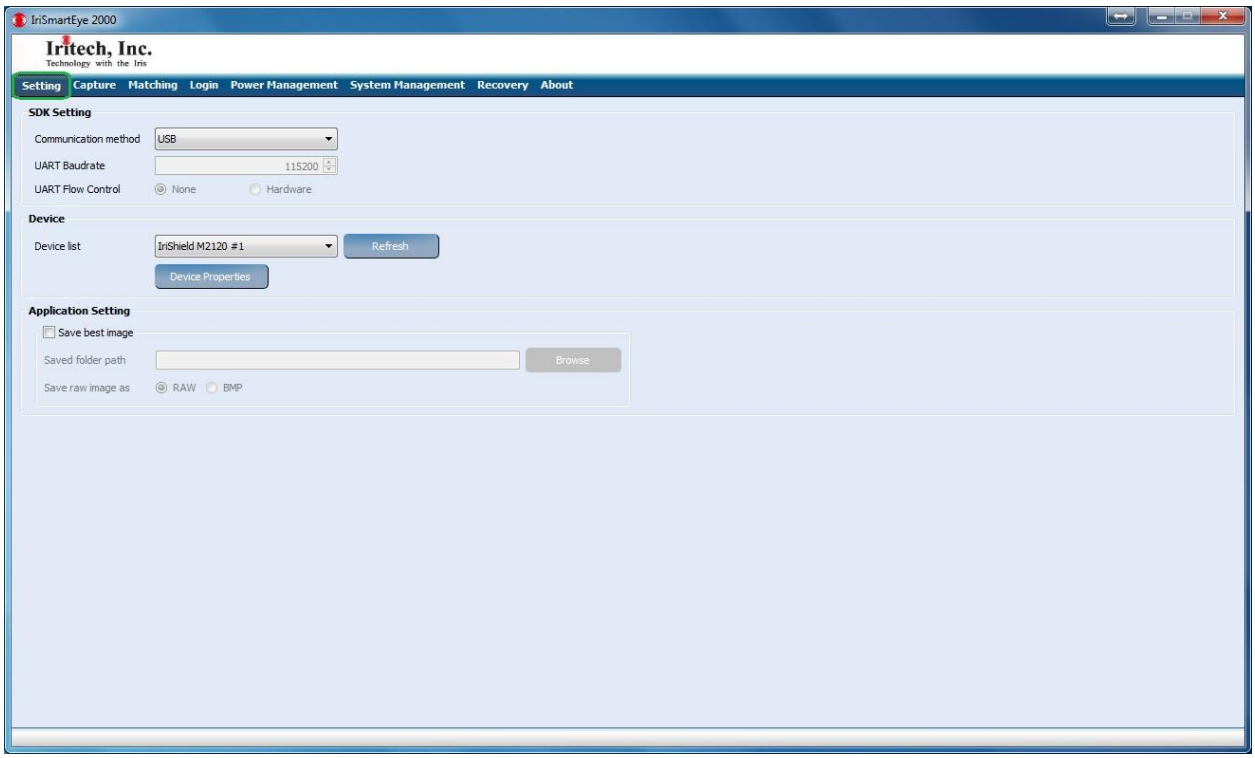
- For Windows XP and Windows 7 OS's, IriSmartEye2000 application can be started from "Start menu → (All) Programs → Iritech → IriSmartEye 2000 → IriSmartEye 2000".

(The installed folder name can be different for other versions.)

8.1 Configuration

This section must be done before any further functionalities of program can get ready to work.

1. Select "**Setting**" tab.



2. Click "**Refresh**" to refresh list of IriShield™-USB device in case of USB communication is selected. In case of UART communication, device list will be a list of available COM ports; user has to choose the COM port to which device is attached.

3. To view more information about the selected device, click "**Device Properties**".

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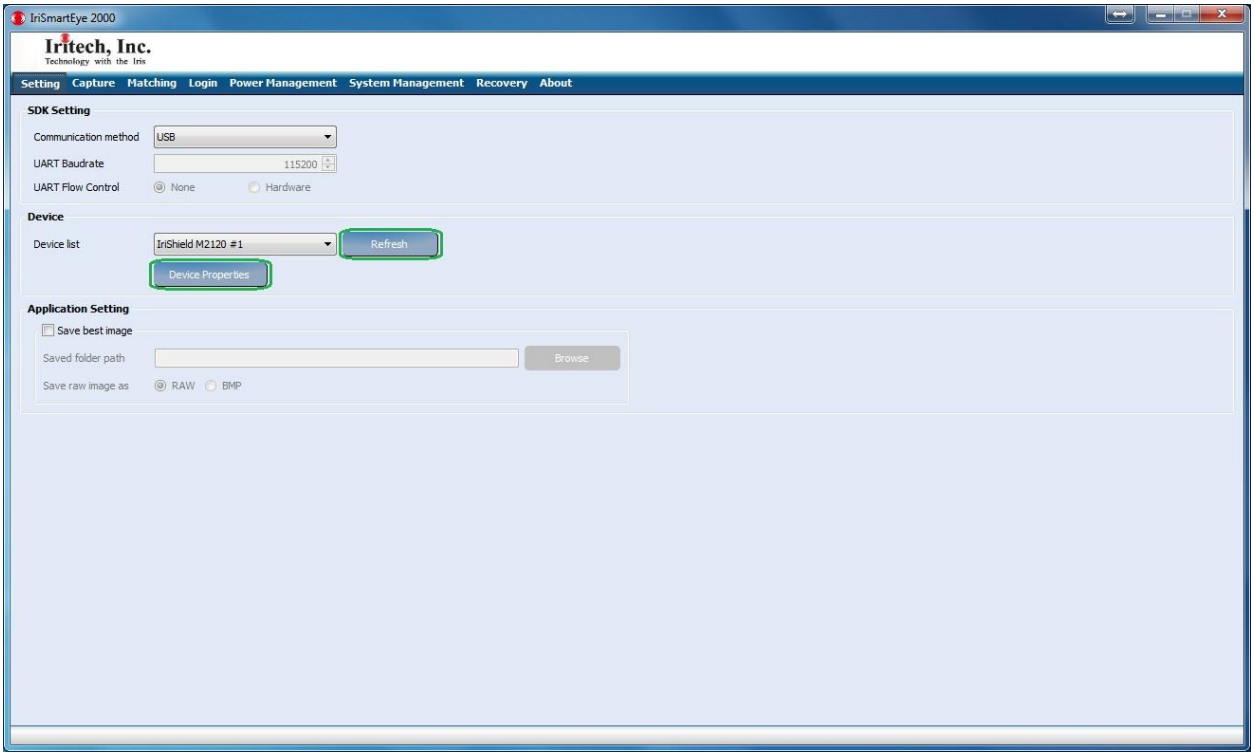

If ***Device Properties*** window does not appear, the selected device and configuration are not correct. User should consider the steps from 1-8 carefully.

8.2 Iris Image Capturing

Select "**Capture**" tab, the screen will be shown as in below.

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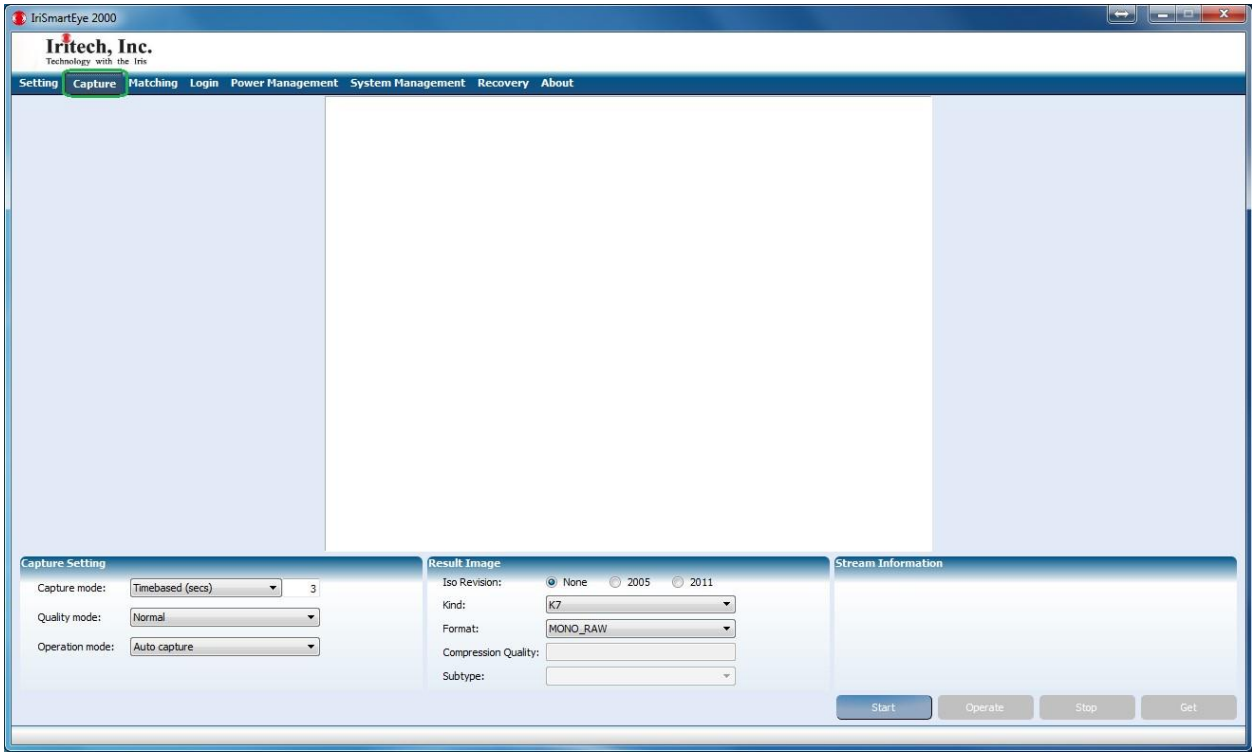
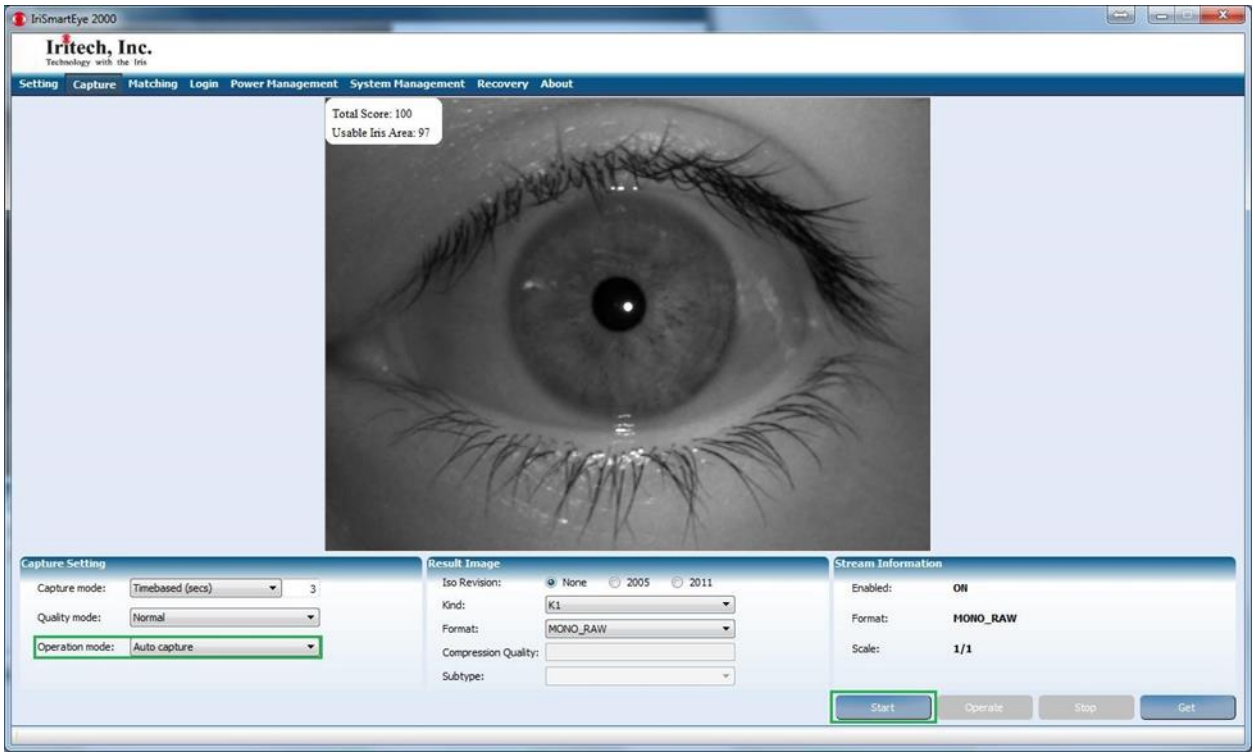


8.2.1 Auto Capture Mode



1. Select the "**Capture**" tab on the IriSmartEye2000 application.
2. Select "**Auto capture**" in "Operation mode".
3. Click "**Start**" button to activate the camera to capture iris image.
4. Keep your eye wide open, look straight ahead, and align the eye so that it is seen in the center of camera mirror. (Closing the other eye may help with the alignment.)

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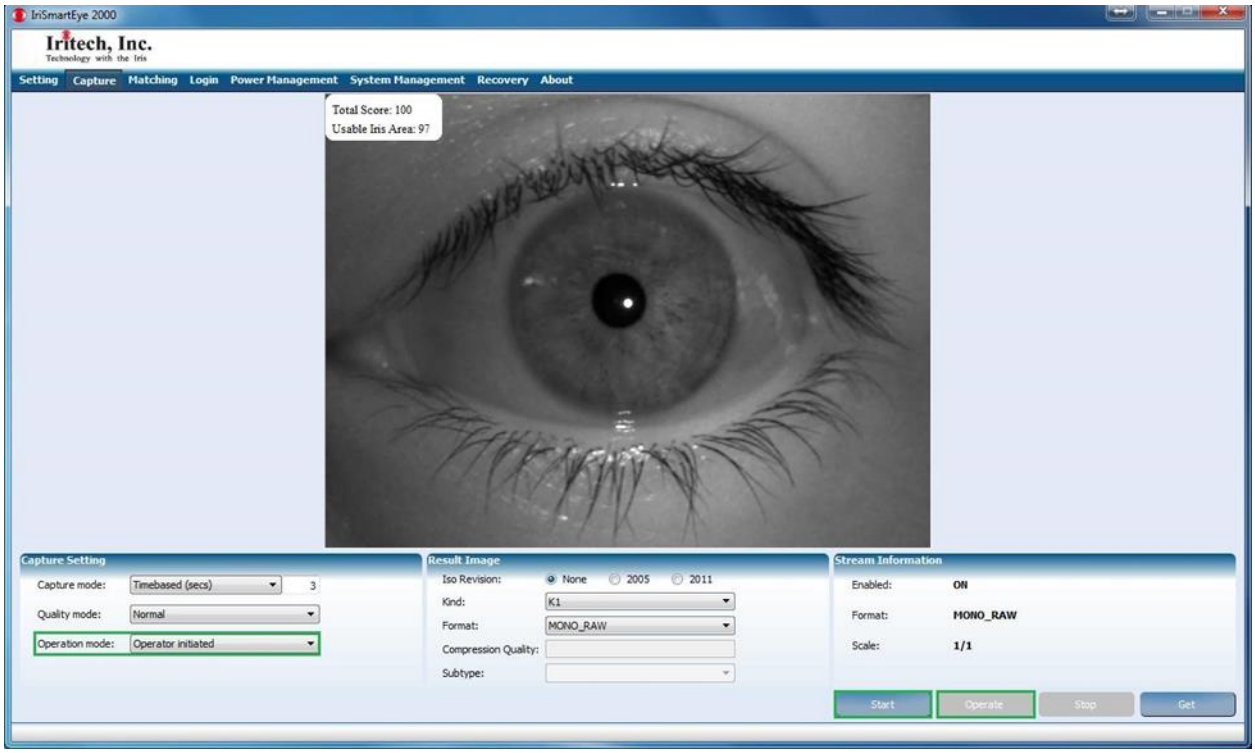
5. **Approach the camera slowly** from a distance of about 5 cm (2 inches) away from the front of camera (The distance is about 13.5 to 14.5 cm for other long range IriShield models, please find more information in 6.1 Capture volume). The IriSmartEye2000 software will say "**Keep moving**" when it detects the first in-focus iris image. (The computer must have a soundcard and a speaker turned on to hear the message.)
6. Once the message "**Keep moving**" is heard, it is best to keep moving steadily towards and backward the camera around focus distance (5cm) until the system sounds with "**Shutter click**", signaling that it has selected a qualified iris image and completed capturing process.
7. If non-qualified iris image is captured, an error message of "**No frame was qualified. Please try again.**" will appear on the computer.

Note: If power is disconnected from the camera, e.g., during closing of a laptop, it will take a few seconds after power is reestablished for the camera to operate as normal.

8.2.2 Operator-Initiated Auto Capture Mode

In this mode, the operator will help enrollee to capture the iris. The operator will start the capture process (click "Start") and decide the moment to get the streaming image for quality assessment (click "Operate").



1. Select the "**Capture**" tab on the IriSmartEye2000 application.
2. Select "**Operator initiated**" in "Operation mode".
3. The operator clicks "**Start**" button to activate the camera to start streaming iris image.
4. When the iris image on the screen is in right position, the operator click "**Operate**" to capture the iris image of enrollee.

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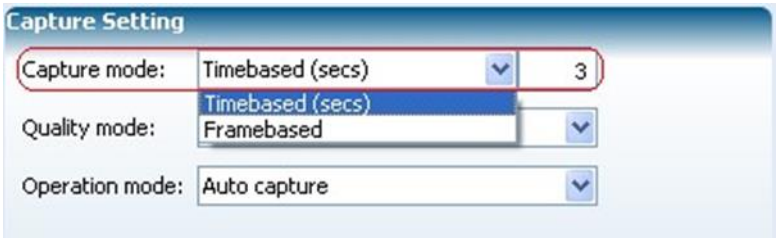
5. Keep your eye wide open, look straight ahead, and align the eye so that it is seen in the center of camera mirror. (Closing the other eye may help with the alignment.)
6. **Approach the camera slowly** from a distance of about 5 cm (2 inches) away from the front of camera (The distance is about 13.5 to 14.5 cm for other long range IriShield models, please find more information in 6.1 Capture volume). The IriSmartEye2000 software will say "**Keep moving**" when it detects the first in-focus iris image. (The computer must have a soundcard and a speaker turned on to hear the message.)
7. Once the message "**Keep moving**" is heard, it is best to keep moving steadily towards and backward the camera around focus distance (5cm) until the system sounds with "**Shutter click**", signaling that it has selected a qualified iris image and completed capturing process.
8. If non-qualified iris image is captured, an error message of "**No frame was qualified. Please try again**" will appear on the computer.

8.3 How to Change Capture Setting

Parameters for capturing process can be modified as in below.

8.3.1 Capture Mode (Time-Based vs. Frame-Based)



In Time-based Capture Mode, the capturing time period (in seconds) is specified as the length of time to capture all qualified eye image frames. When the capturing period times out, the application will choose the best quality image from the collection of qualified frames. If this image satisfies the Minimum Quality Tolerance condition as set in the Quality Mode, the application will return it as the captured image. Otherwise, the user will be asked to perform the capturing process again.

In Frame-based Capture Mode, the number of qualified images stored is specified. The best image will be selected from these qualified images and checked against the Minimum Quality Tolerance condition, as in the time-based mode.

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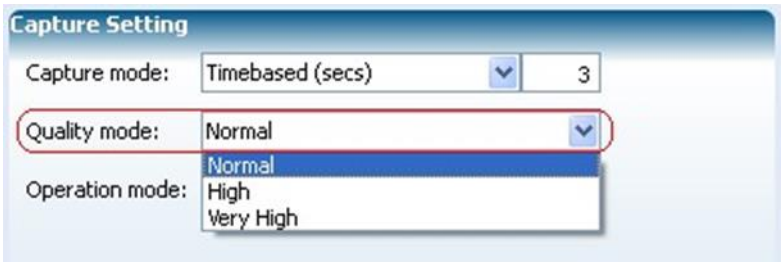
8.3.2 Minimum Quality Tolerance



The Minimum Quality Tolerance parameter specifies the minimum quality level of the accepted iris images. They are classified as follows:

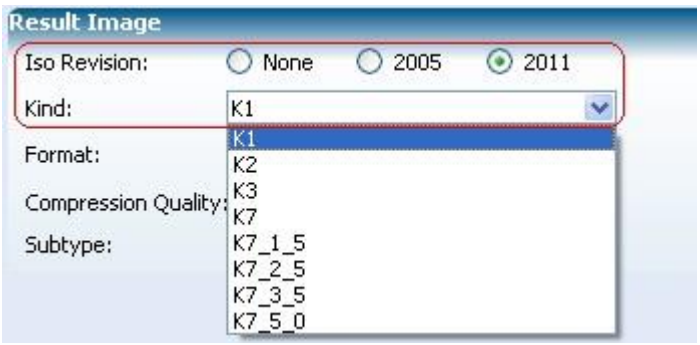
- **Normal:** This is the least stringent condition on the quality of the accepted frames and suitable for everyone regardless of eye color. With this choice, the camera operation tends to be more userfriendly, but there is a higher risk the system will accept a lower quality image as output. However, in general, most images in this mode will be of excellent quality.
- **High:** In this setting, the camera operation may be less user-friendly than the "Normal" mode. However, the system will tend to exclude lower quality images. The "High" Minimum Quality Tolerance condition provides better analysis for the people with darker eyes such as Arabs, Africans, Asians, and Eastern Europeans.
- **Very High:** Running in the "Very High" Minimum Quality Tolerance condition, the capturing application tends to accept only the highest quality images and may sometimes require recapturing. In this mode, the output image's quality tends to be very good. This mode is often used when user convenience may not be a priority choice.

Based on the capturing environment and the requirement of iris image quality, the users may adjust the Minimum Quality Tolerance to make it suitable for their applications.

8.3.3 Result Image Option

8.3.3.1 ISO Revision and Image Kind

IriShield™-USB device provides K1, K2, K3, and K7 image kinds as defined in the ISO/IEC 19794-6:2005 or the ISO/IEC 19794-6:2011 standard. When "Iso Revision" is "None", the output image will be in normal format, such as RAW, JPEG2000, or IriTech proprietary formats.



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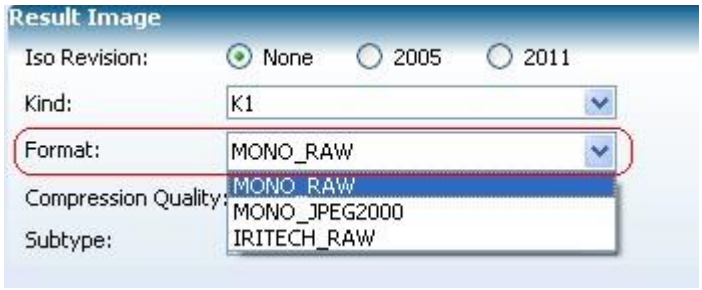
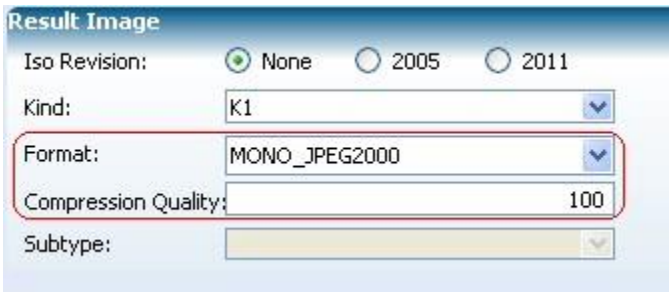
8.3.3.2 Image Format

IriShield™-USB device supports to save the output images in RAW, JPEG2000, or IriTech proprietary formats.



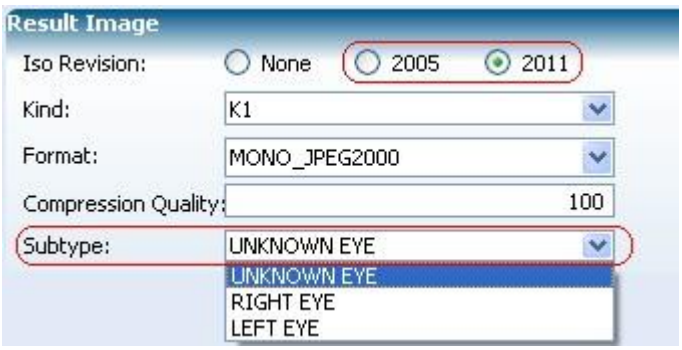
8.3.3.3 Compression Quality

When "JPEG2000" image format is selected, user can input the compression quality. The compression value should be in range [1, 100].



8.3.3.4 Subtype

When Iso Revision is "2005" or "2011", user can select the "Subtype" of the ISO image. The "Subtype" value can be "UNKNOWN EYE", "RIGHT EYE", or "LEFT EYE".



8.3.3.5 Streaming Option

Streaming options, such as status, scale, and image format, can be configured in the System Management. Then, when an image is captured, current configured settings will show on the screen as in below.

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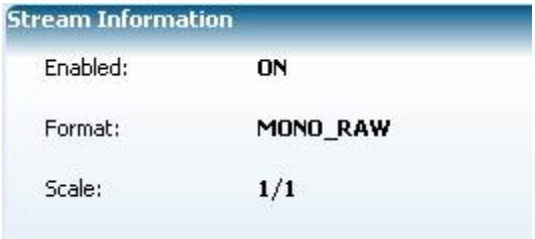

8.3.3.6 Streaming Status

Streaming status must be set to "**ON**" to have the streaming images displayed on the software's GUI.

8.3.3.7 Streaming Image Format

1. For USB communication, only RAW format is supported. For UART communication, RAW and JPEG streaming format are supported. Due to the slow speed of UART, JPEG streaming and small scale ratio are recommended for smooth streaming.
2. In case of JPEG streaming, compression ratio must be set in range of [1, 100].

8.3.3.8 Streaming Scale

Streaming scale reduces the size of streaming images to support smoother streaming when USB is not high-speed or UART is used.

NOTE: If UART is used, streaming image scale should be reasonably small (e.g., ¼ or smaller) to have smoother streaming.

8.3.3.9 Get Result Image

IriSmartEye2000 allows to get various image kinds/formats from the current captured iris image. When the capturing process finished, users are able to change result image options above and then click "Get" button to get a desired iris image format without re-capturing their iris.

8.4 Matching

1. Select "**Matching**" tab.

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2. This section includes four functionalities: Enroll, Unenroll, Verify, and Identify.

8.4.1 Enroll

8.4.1.1 Notices on the Image Quality

Iris image quality is a determining factor regarding the accuracy of iris-based identification. Higher quality images produce more accurate iris recognition results. Iris image quality could be affected by several factors including:

- *Poor capturing conditions*
- *Heavy occlusion by eyelid, eyelashes, or by foreign objects*
- *Image blurriness caused by excessive movement*
- *Iris nonlinear/non-uniform deformation due to pupil's constriction and dilation*

Therefore, the operator should ensure that the user opens his or her eyes widely and moves slowly in the focus range, especially when doing capturing for enrollment.

8.4.1.2 Failed to Enroll

Failure to enroll (FTE) prevents subjects from rightfully being registered in the system and reduces the overall value of the entire solution. This system error needs to be minimized. However, proper rejection of enrollment images that do not meet pre-defined quality requirements is a desirable feature of any biometric system and should not be confused with failure to enroll.

Significant contributors to FTE include:

- **Blind or Disabled People**

The capture device should complete the enrollment process regardless of a person being sighted or blind. Likewise, a binocular camera, able to normally capture two iris images simultaneously, should independently assess and capture each iris image. This provides the ability to properly enroll a person even if one eye is permanently closed, damaged, or missing.

- **Lazy Eye (Amblyopia)**

Amblyopia, also known as lazy eye, is a disorder of the visual system that is characterized by poor or indistinct vision in an eye that is otherwise physically normal, or out of proportion to associated structural abnormalities. It has been estimated to affect 1–5% of the human population. A specially trained operator is needed for people who have lazy eye. If the operator assists the enrollee to focus on the camera during the capture process, it should be possible to capture an image that is of sufficient quality to be used for iris identification. The operator will need to review the image to ensure its quality.

- **Contact lens**

- **Hard or Colored contact lens**: Since hard contact lenses and colored contact lenses are likely to interfere with the image quality, they should not be worn during image acquisition.
- **Soft contact lens**: Though recommended not to, wearing soft contact lenses is still allowed during image acquisition.

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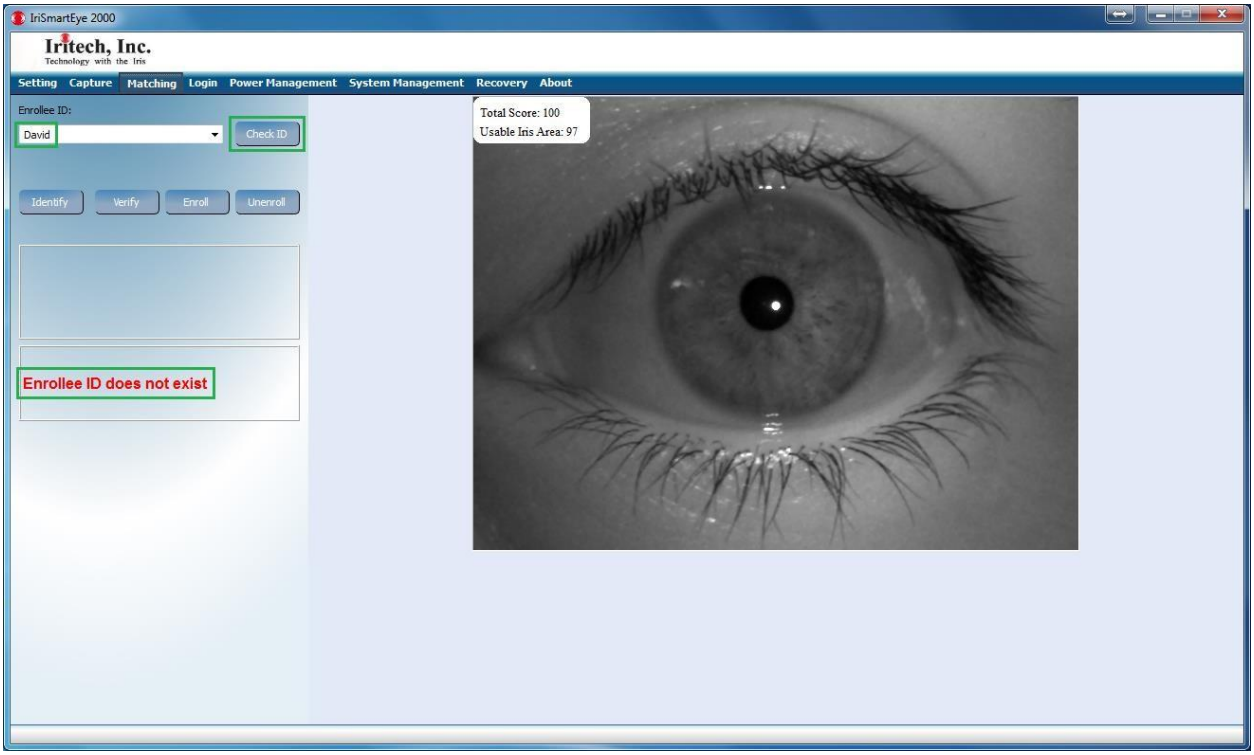
- **Damage of iris pattern due to eye surgery**

Most eye surgeries, including LASIK eye correction, do not affect the accuracy of iris recognition. However, certain eye disease or surgery that hides or changes the iris pattern may degrade the accuracy. Therefore, the capture device should have the ability to detect and reject iris images where the iris is significantly affected by surgery. Re-enrollment should be scheduled if the surgical artifacts heal over time. It is also important to properly establish the identity of the person before the unenrollment and the new registration.

8.4.1.3 How to Enroll

The following steps guide user how to enroll captured irises into device with an entered enrollment ID number.

1. After the capturing process, the captured image in the device will be displayed on the software window. Repeat the capturing if the operator is not satisfied with the captured image's quality, e.g., too much occlusion, red-eye effect, side-gazing, too much reflection on the iris, or motion blur.
2. Enter an enrollment ID, which is an alphanumeric (numbers 0 to 9 and letters A to Z, a to z) and has maximum length of 31 characters, as the identity of that enrollee in the device. Click "**Check ID**" to see whether the entered ID has already been used.



If the ID exists in the device, the program will show the number of iris images enrolled with that ID. The maximum number of iris images per one enrollee is eight.

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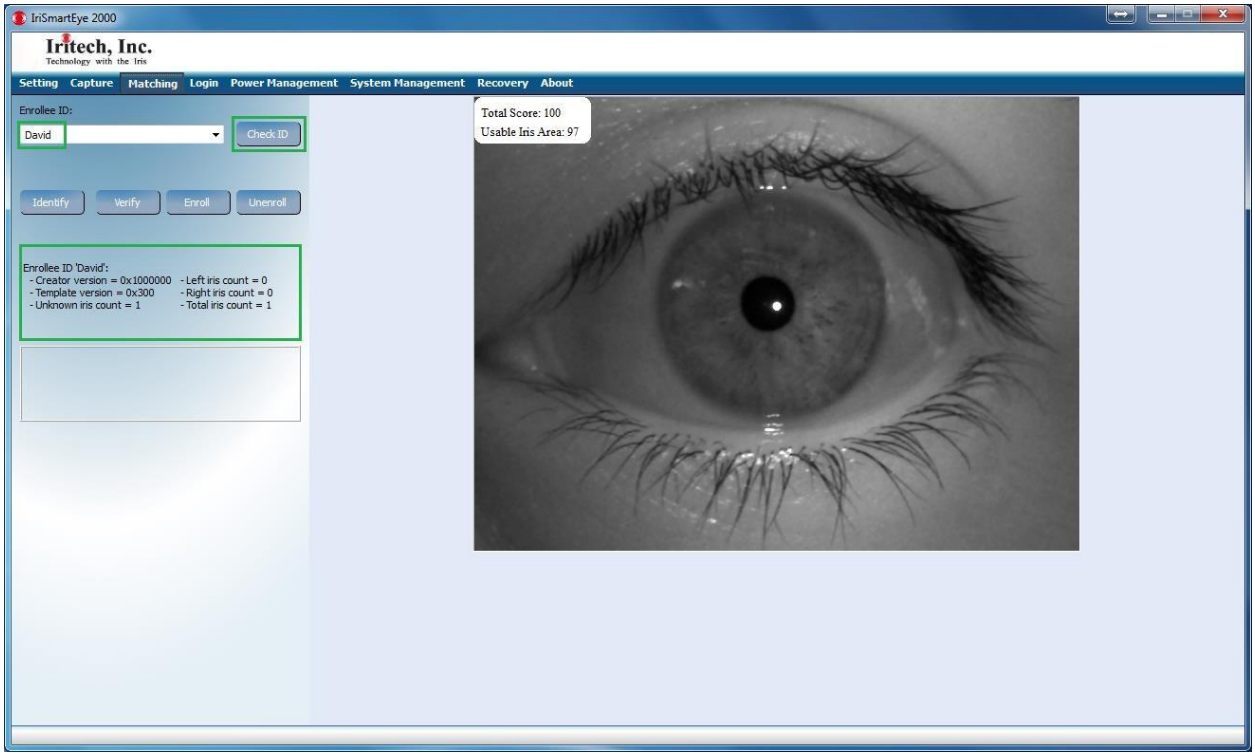
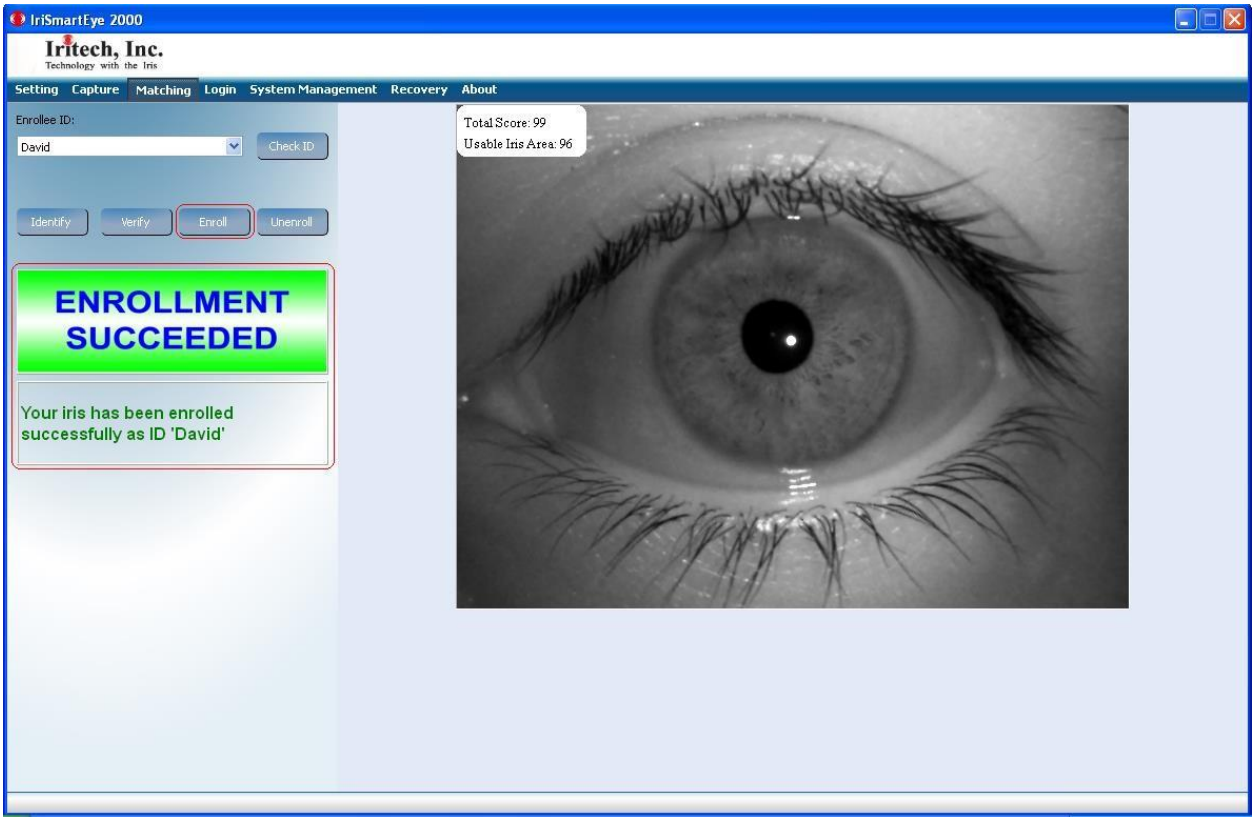


3. Click "**Enroll**" to enroll the current captured image into device with the entered enrollment ID.



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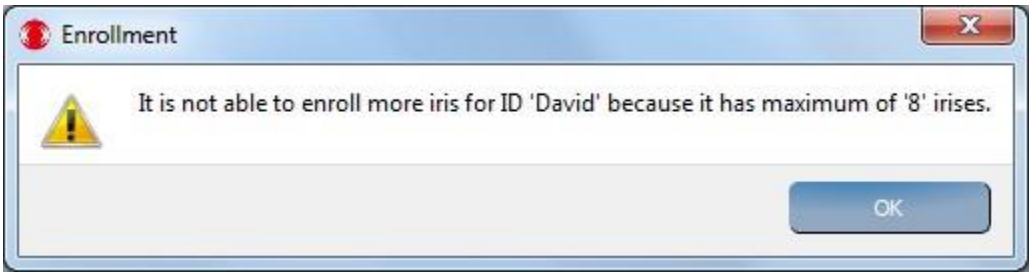
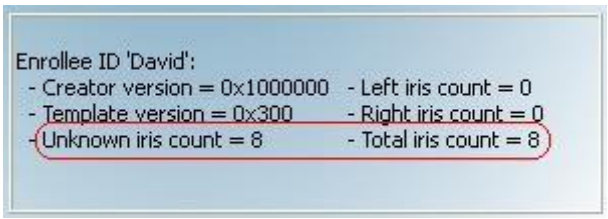
4. The maximum of eight iris images are allowed to be enrolled for one ID. When all slots per ID are occupied, no more irises for that ID are accepted.

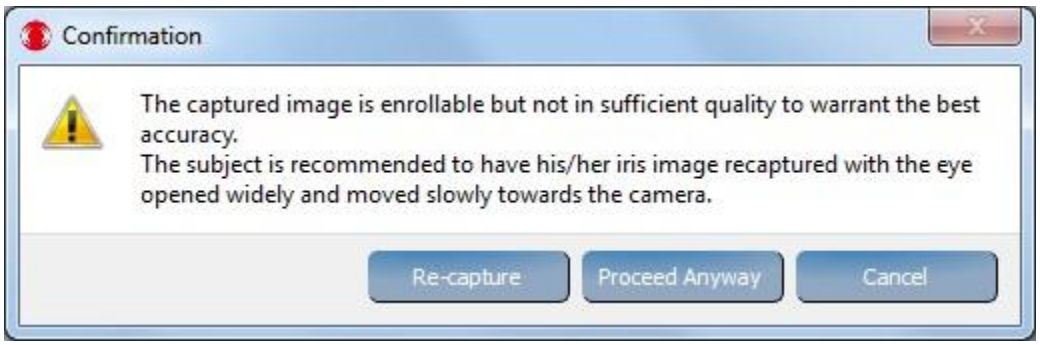


5. Click "**Check ID**" to view the status of the selected ID.



Note:

The IriSmartEye2000 checks image quality before enrollment and matching. Now and then, a warning message shows if captured image is not qualified for a specific operation. Enrollees should NOT proceed when this warning message is prompted. The warning message is shown as in below.



8.4.2 Unenroll

1. Select an ID from existing enrollee ID list.
2. Click "**Unenroll**" to remove the corresponding enrollee from device.
   (Note that users do not need to capture iris image for unenrollment.)

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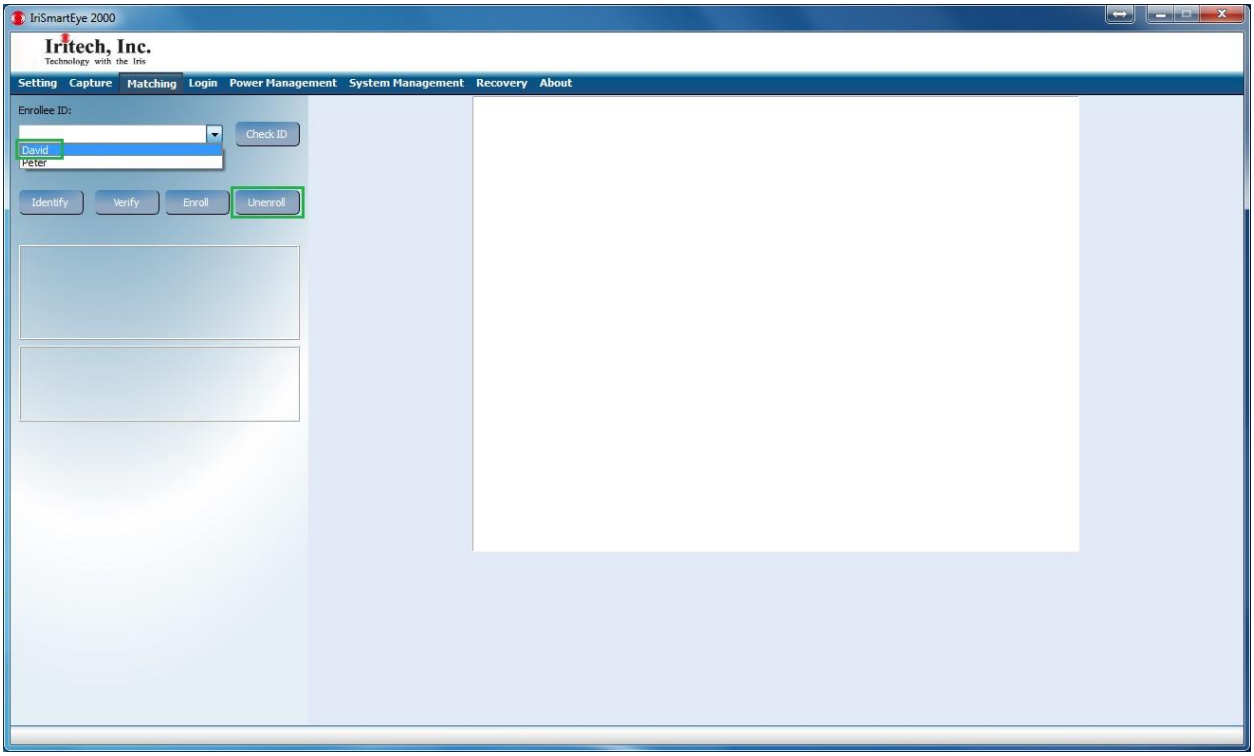
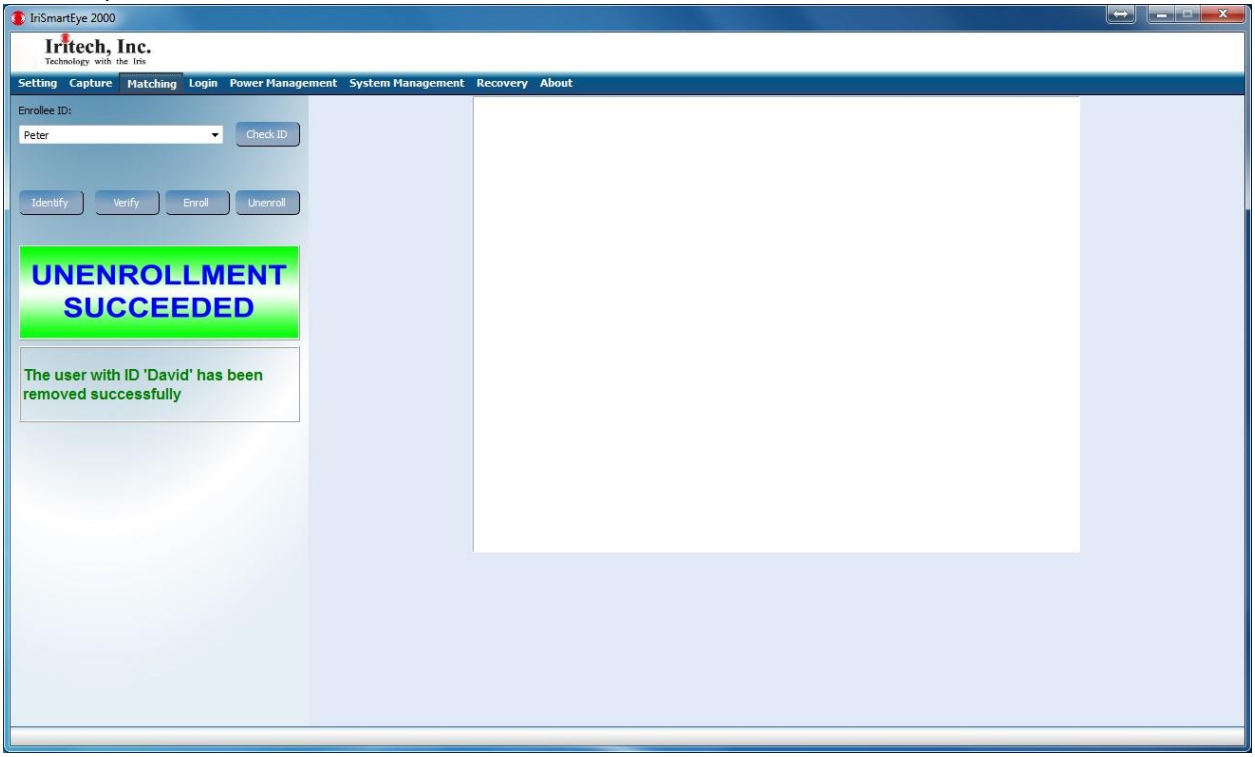


3. Once the unenrollment completes successfully, the enrollee list will be automatically updated.



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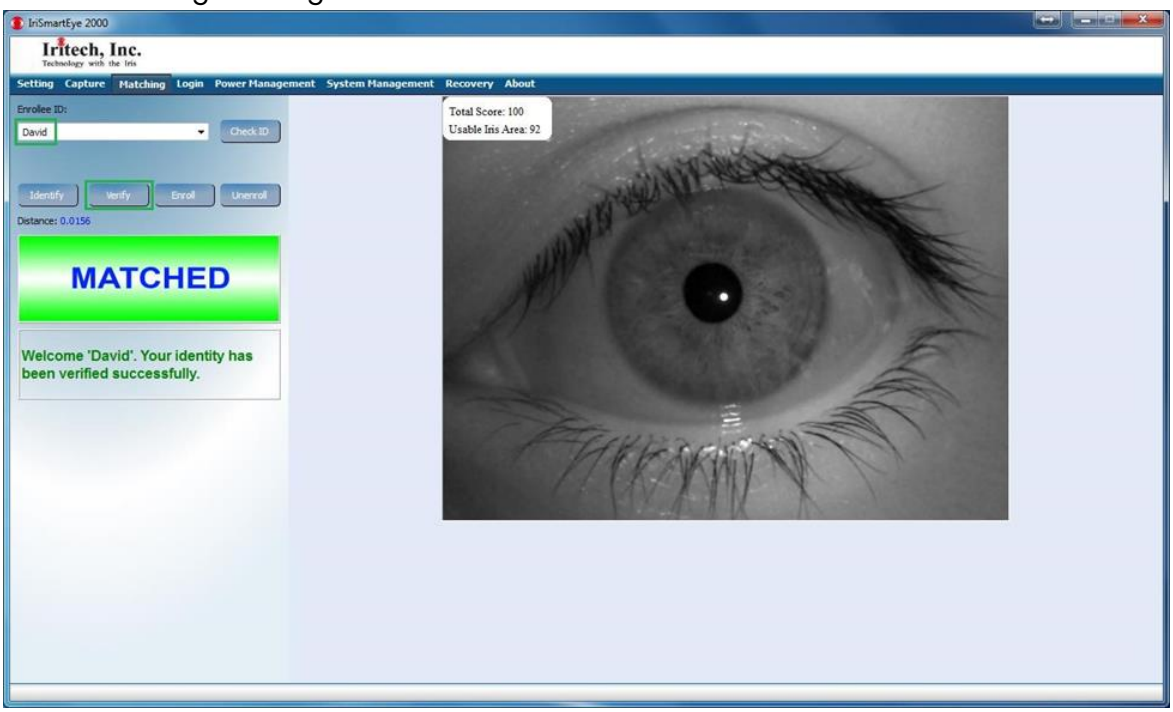
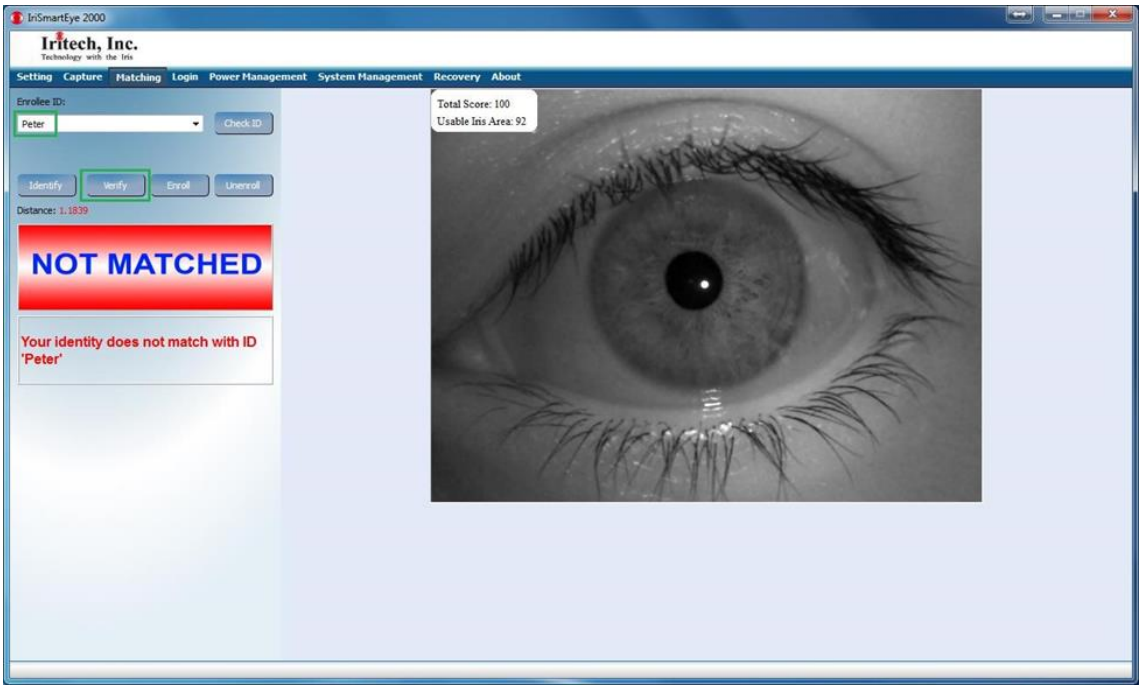
8.4.3 Verify

1. After getting a captured iris image, select an enrollment ID against the image that needs to be verified.
2. Click "**Verify**" button. If the image belongs to the person with that ID (i.e., positive match), the resulting message is shown as in below.



3. If the image is from an imposter (a person different from the one with the selected ID), the negative message is shown as in below.



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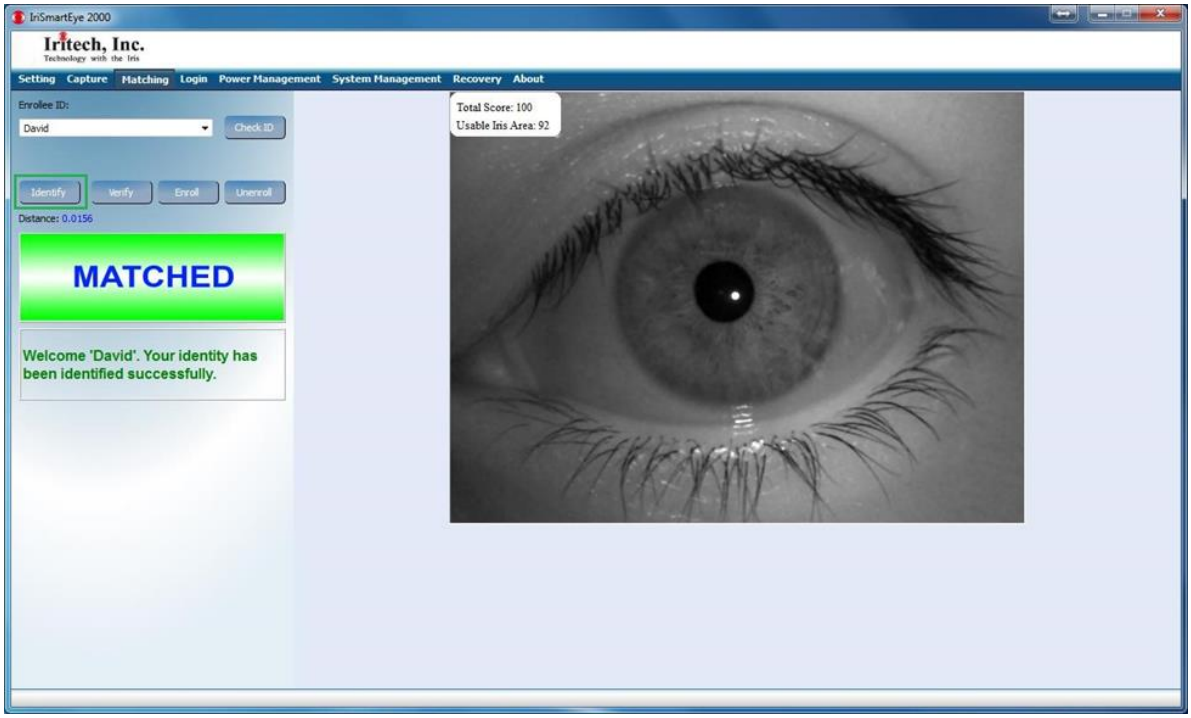
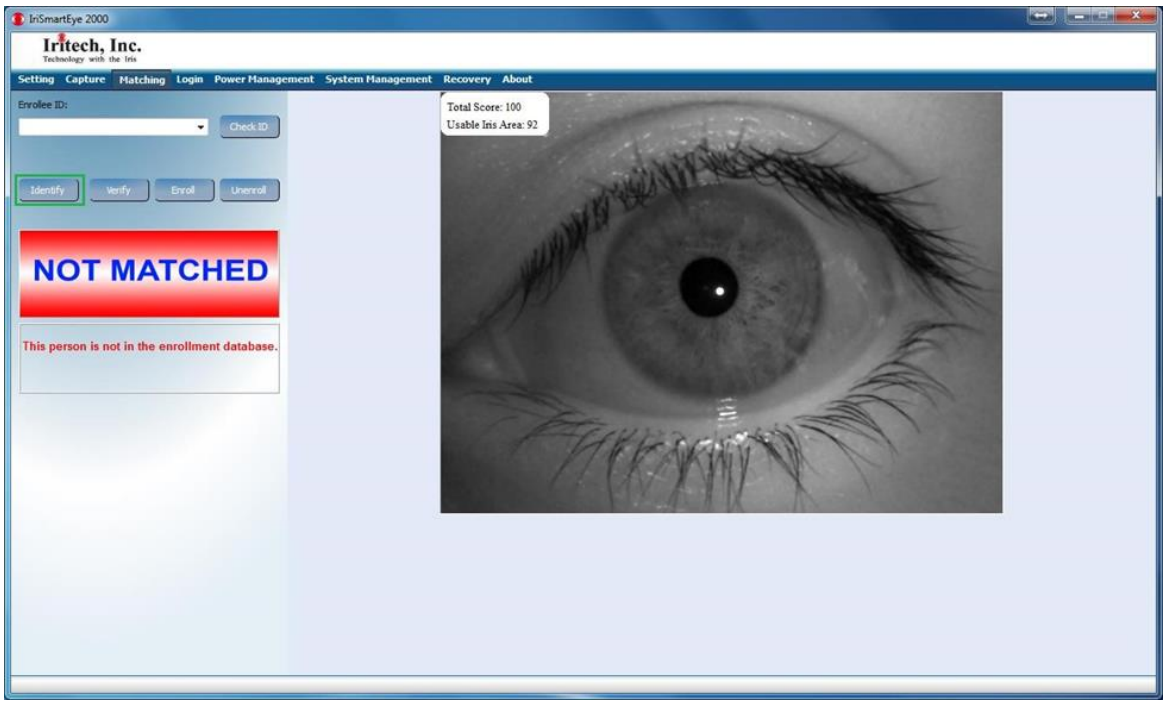
8.4.4 Identify

1. Capture an iris image.

2. Click “Identify” to identify the enrollee from the enrollee list. Once located, the corresponding ID will be shown in the resulting message as in below.



3. If the image does not match with anyone from the enrollee list, a negative message will be shown as in below.



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8.5 Power Management

8.5.1 System Roles

This function is used to put IriShield™ device in a power-saving mode. There have been two power schemes released along with IriShield™ firmware: First-released Power Scheme and Second-released Power Scheme.

8.5.1.1 First-released Power Scheme

This power scheme only supports USB-enabled device and includes two different power-saving modes: STANDBY and SLEEP.

Power modes	Description	Wakeup by	Cautions
STANDBY	Device's main processor enter idle mode. Its peripherals (flash, uart, usb, GPIO, etc.) are still full clocked and powered. Device goes into STANDBY when - Iddk_SleepDevice is called	Any activity on USB/UART communication link (except for KEEP ALIVE frames from USB).	
SLEEP	Operating clock frequency is lowered down. Peripherals and memory enters minimum power consumption states. Main processors enters idle mode. Device goes into SLEEP when - Iddk_SleepDevice is called	Re-enumeration on USB port	Device needs some amount of time (several hundred miliseconds) to put itself into SLEEP. During this time, it puts its peripherals including USB and itself into low power state. If there is an incomming command during its sleeping procedure, communication is corrupted and host may receive unexpected data or error.

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8.5.1.2 Second-released Power Scheme

IriShield device offers different power-saving schemes including STANDBY, SLEEP and DEEPSLEEP during device's idling period. Not only is the power consumption of SLEEP and DEEPSLEEP different from the previous scheme but also the ways to wake device up from those saving modes are also different. STANDBY stays the same for both schemes.

Power modes	Description	Wakeup by	Cautions
STANDBY	Device's main processor enter idle mode. Its peripherals (flash, uart, usb, GPIO, etc.) are still full clocked and powered. Device goes into STANDBY when - Iddk_SleepDevice is called - Device is configured to automatically go into STANDBY after some idling time.	Any activity on USB/UART communication link (except for KEEP ALIVE frames from USB).	
SLEEP	Operating clock frequency is lowered down. Peripherals and memory enters minimum power consumption states. Main processors enters idle mode. Device goes into SLEEP when - Iddk_SleepDevice is called - Device is configured to automatically go into SLEEP after some idling time. - There is no activity on USB bus for more than 3 milliseconds.	Access to any API in the corresponding SDK (Please refer to the API reference manual for more detail).	Device needs some amount of time (several hundred miliseconds) to put itself into SLEEP. During this time, it puts its peripherals including USB and UART as well as itself into low power state. If there is an incomming command during its sleeping procedure, communication is corrupted and host may receive unexpected data or error.

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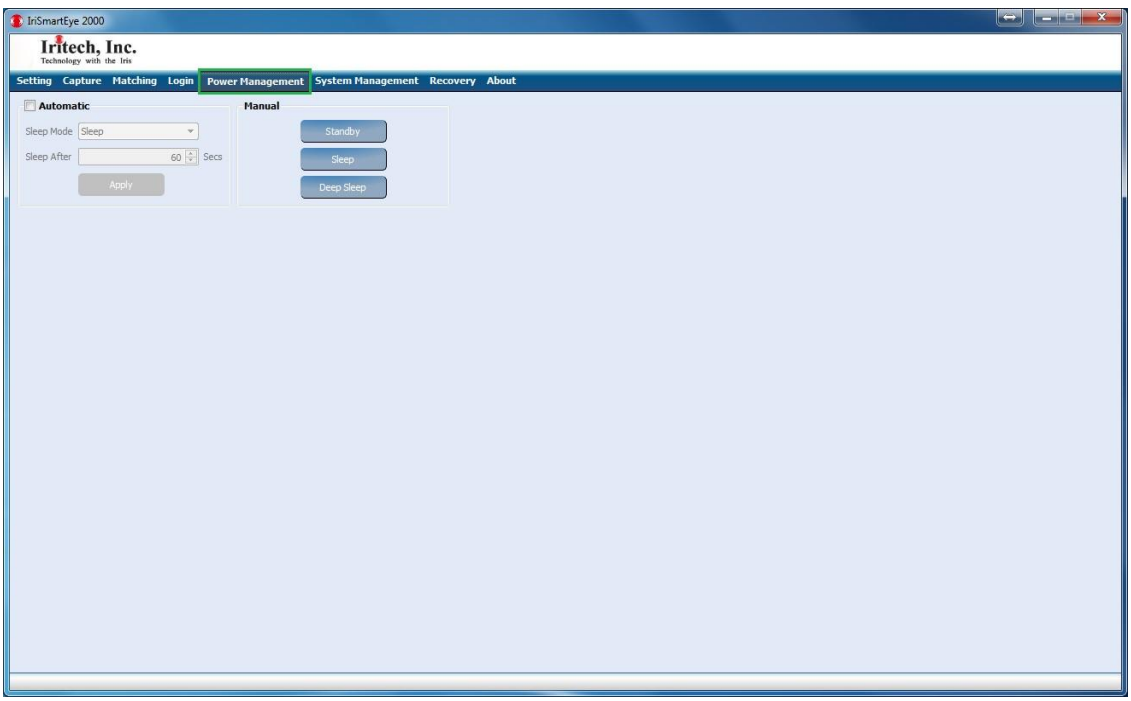
DEEPSLEEP	Device's peripherals and memory are either powered off or put into deep sleep state. All communication components including USB and UART are powered off. Device goes into DEEPSLEEP when - Iddk_SleepDevice is called + Device is configured to automatically go into DEEPSLEEP after some idling time. - Device is configured to automatically go into DEEPSLEEP when a falling edge is detected on DS_input PIN.	An external interrupt generated by a level shift from logical low to logical high of DS_input pin (a rising edge).	Device is totally in deep sleep mode only when DS_input pin is logical low. When an USB-enabled device is in deep sleep, it is detached from host system as if it was unplugged when a USB-enabled device is fully waken up, it needs reenumerating by USB host.

8.5.2 Functionality

1. Select "**Power Management**" tab.



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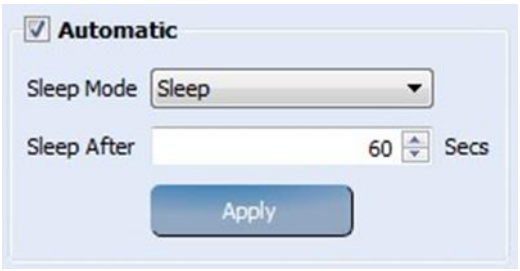
2. Select "**Automatic**", and choose desired value of "Sleep Mode" and "Sleep After" to put IriShield into Sleep Mode automatically



3. In "Manual" group, select one of following buttons "Standby", "Sleep", and "Deep Sleep" to put IriShield into Sleep Mode manually.

Note that Device is totally in deep sleep mode only when DS_input pin is logical low.

8.6 System Management

8.6.1 System Roles

To prevent unauthorized accesses and configuration, the device can be customized to allow only authenticated users to perform their granted tasks. For system management, device defines three groups of users named Administrator (ADMIN), Super user (SUPERUSER), and normal user (USER).

ADMINs are stored in a different gallery from the one for SUPERUSERs and USERs. Each device can store up to five ADMINs into that gallery. An ADMIN can do all functions in "System Management" tab, which are related to device's management, except the "Set Role" function. If there is no ADMIN in the system, those functions are open.

SUPERUSERs and USERs are stored in the main template gallery of device. Both SUPERUSERs and USERs can perform "Capture", "Verify", and "Identify." However, if at least one SUPERUSER exists in the system, a SUPERUSER must login to access the "Enroll", "Unenroll", and "Set Role" functions. Otherwise, these functions can be done by any USER, who then has full privileges of a SUPERUSER.

Note that if the parameter "Supervised Enrollment" in "Configuration" is not selected, a USER can do "Enroll" and "Unenroll" regardless of the existence of a SUPERUSER.

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Table 2 Descriptions of User's Roles in System Management

Role	Description
ADMIN	ADMIN has authority to configure most features in System Management including: ❖ Capture ❖ Enroll/Unenroll ADMIN user ❖ Login/Logout as ADMIN role ❖ Lock/Unlock device ❖ Change device's configuration ❖ Delete/Generate Certificates
SUPERUSER	SUPERUSER has authority to do following tasks: ❖ Capture ❖ Verify /Identify ❖ Login/Logout as SUPERUSER role ❖ Enroll/Unenroll USER or SUPPERUSER ❖ Set ROLE for a user (USER or SUPERUSER)
USER	If there is no ADMIN and SUPERUSER in the system, all functions are open to a USER. If there is no SUPPERUSER in the system, but a ADMIN exists, a USER can do following tasks: ❖ Capture ❖ Verify/Identify ❖ Enroll/Unenroll USER ❖ Set Role for a USER Otherwise, if both SUPPERUSER and ADMIN are existing, a USER can only do the following tasks: ❖ Capture ❖ Verify/Identify ❖ Enroll/Unenroll USER (However, USER cannot do enrollment or unenrollment when "Supervised Enrollment" option in "Device Configuration" is checked.)

8.6.2 Functionality

1. Select "**System Management**" tab.

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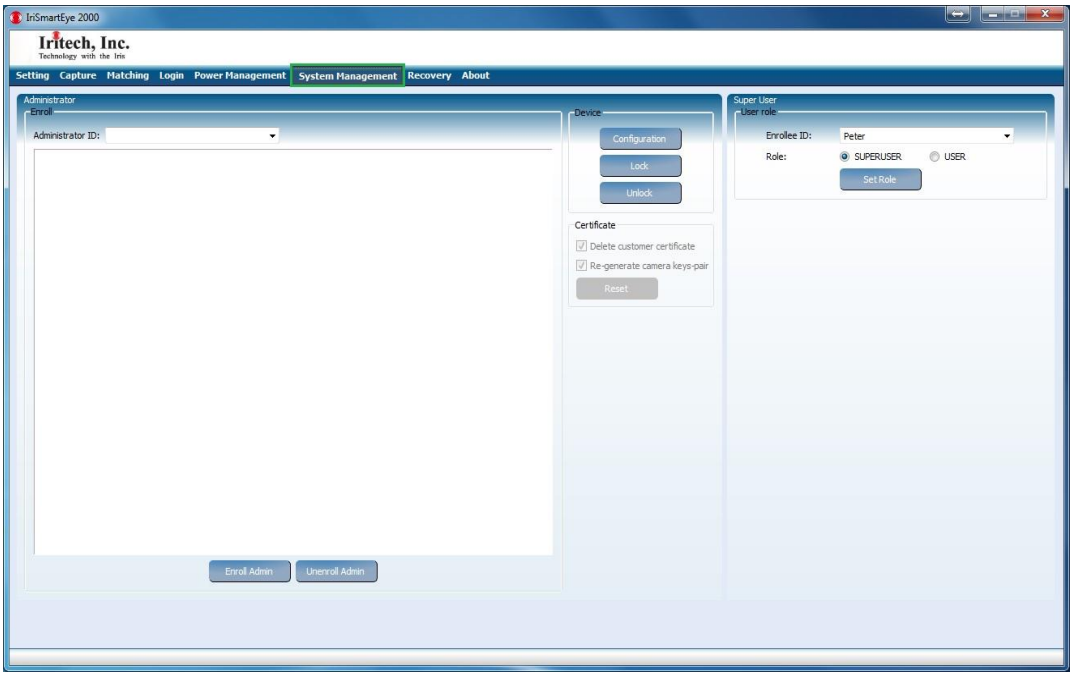
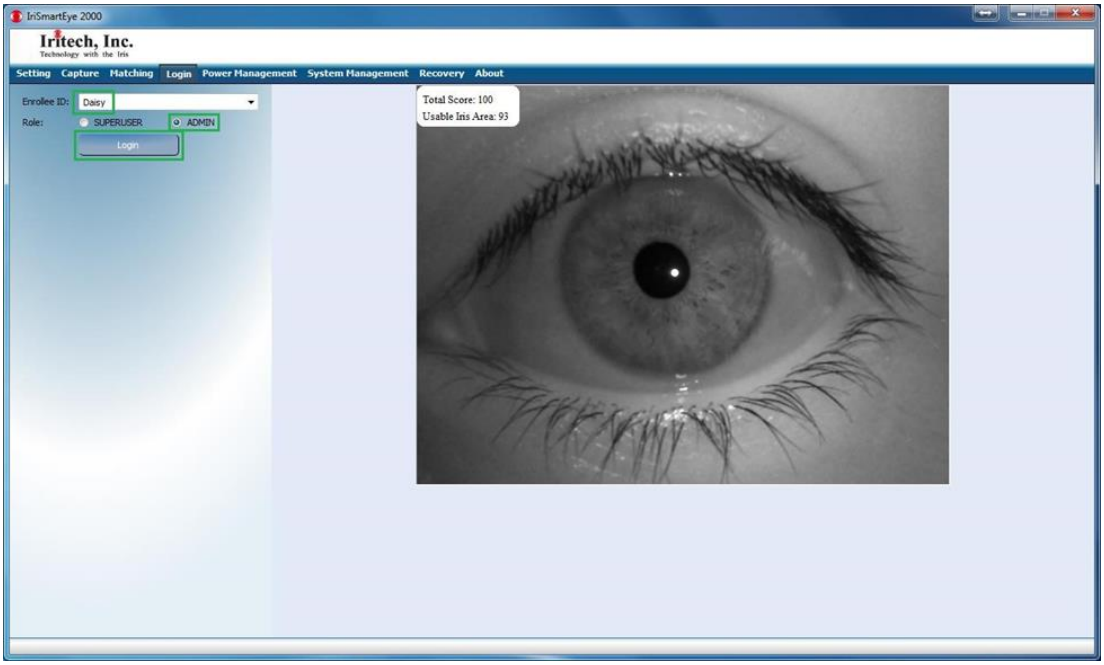


2. This section includes the following functionalities: Enroll/Unenroll Admin, Set Role for SuperUser/User, Lock/Unlock/Configure Device, and Certificate.
3. If no ADMIN user has been enrolled, any user can access the Enroll/Unenroll Admin, Lock/Unlock/Configure Device, and Certificate functions.
4. If no SUPERUSER has been enrolled, any user can access the Set Role (SuperUser/User) function.
5. An operator with ADMIN or SUPERUSER role then must login to access corresponding functions in the System Management.



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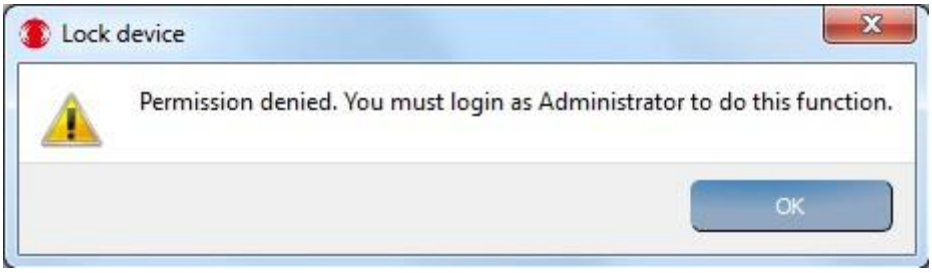
6. Otherwise, an error message will be shown as in below.



Or

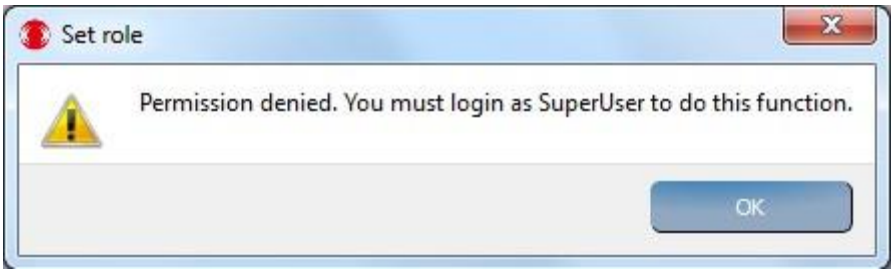


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Table 3 Descriptions of Functions in System Management

Function	Description
Enroll Admin	This function is to enroll an Admin user. The maximum number of Admin users allowed in IriShield is five, and each user can be enrolled with up to eight iris images. If at least one Admin user has been registered in the system, an Admin user must login to access this function (i.e., enroll another Admin user). Otherwise, any operator with a captured iris image can register himself/herself as an Admin user.
Unenroll Admin	This function is to unenroll an Admin user. Only an Admin user can unenroll himself/herself or other Admin users.
Set Role	This function is to set role for a user as a SUPERUSER or a USER. If at least one SUPERUSER has been registered in the system, a SUPERUSER must login to access this function. Otherwise, any operator (either an enrollee or not) can set role for any enrollee.
Configuration	This function is to configure parameters of IriShield. Only Admin users (if at least one exists) can access this function. Please refer to *9.28.3.18.6.5.1 Configure Device* section for more details.
Lock	This function is to lock IriShield. When device is locked, most functions become disabled, except the capturing function. However, no image will be returned when capturing process finishes. Only Admin users (if at least one exists) can access this function.
Unlock	This function is to unlock IriShield device. Only Admin users (if at least one exists) can access this function.
Reset	This function is to delete customer's certificate and/or re-generate camera pairs of keys. Only Admin users (if at least one exists) can access this function. This function is one of the Security Infrastructure features of the IriShield camera, but the IriSmartEye software currently does not fully support those features. Please refer to the Software Developer's Manual and API Reference Manual for more details about this function.

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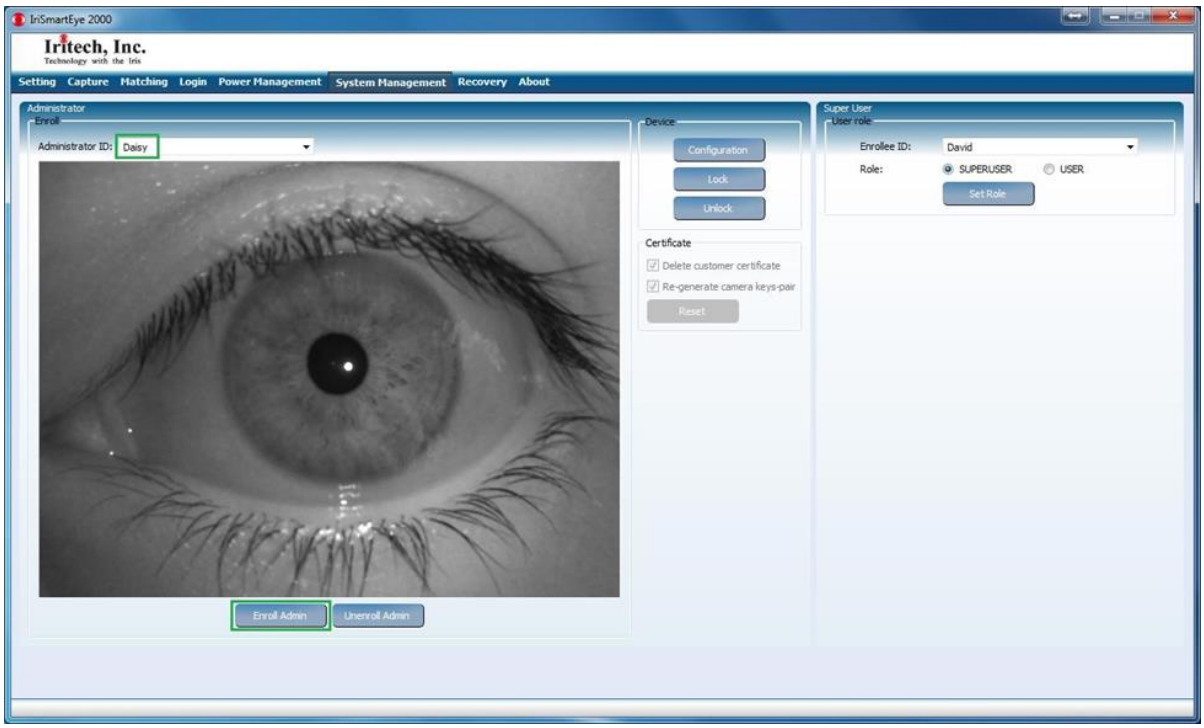
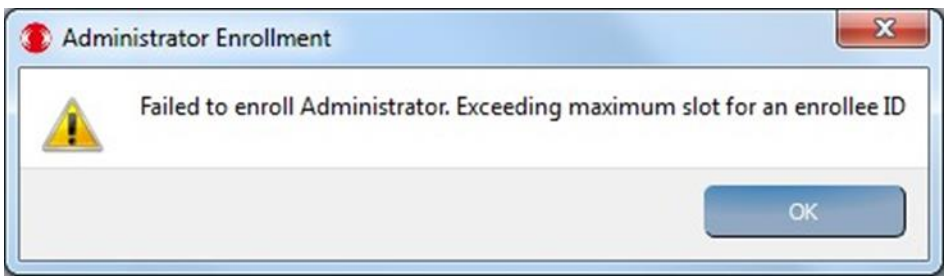
8.6.3 Enroll/Unenroll Admin User

8.6.3.1 Enroll Admin User

1. If at least one Admin user exists in the system, an Admin user must login first.
2. Capture an iris image of the target user who will be registered as an Admin user.
3. Type an ID in the Admin ID box and click "**Enroll Admin**" to enroll an Admin user.



Note: The Administrator's template gallery can store up to five Admin IDs (Each ID can contain up to 8 templates). If the number of Administrator's templates exceeds the limit, an error message will be shown as below.



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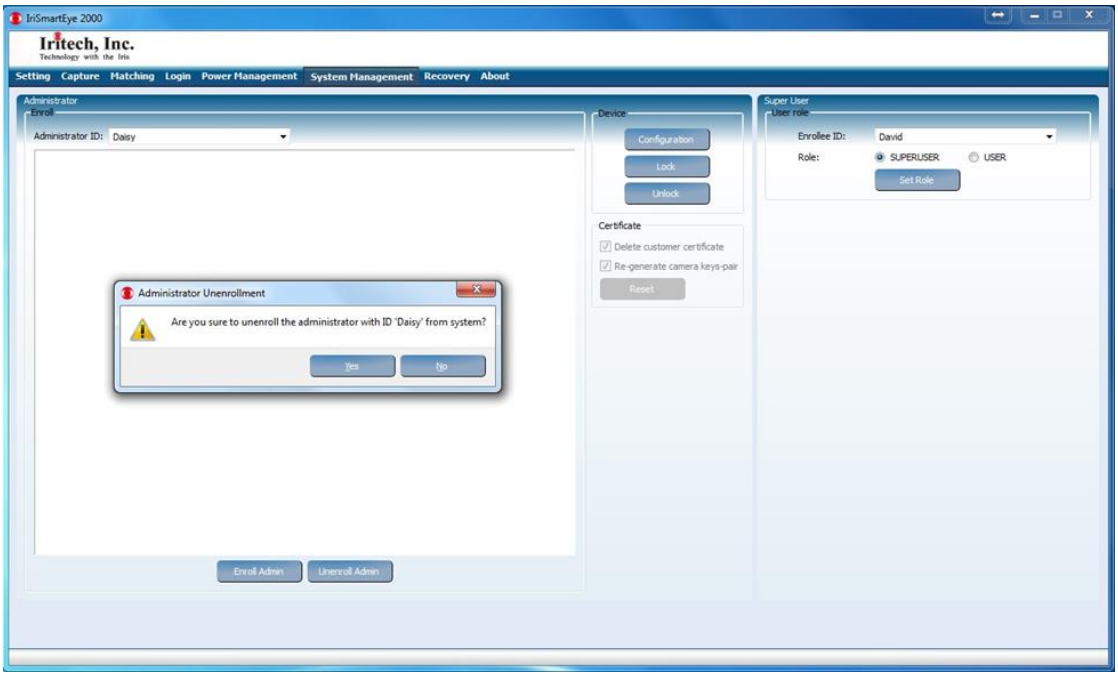
8.6.3.2 Unenroll Admin User

1. If at least one Admin user exists in the system, an Admin user must login first.
2. Select a target Admin ID and click "**Unroll Admin**" to unenroll that Admin user.



8.6.4 Set Role for SuperUser/User

1. If at least one SUPERUSER exists in the system, a SUPERUSER must login first.
2. Select an ID from the enrollee list, select the desired Role, and click "**Set Role**" to set role to that enrollee.

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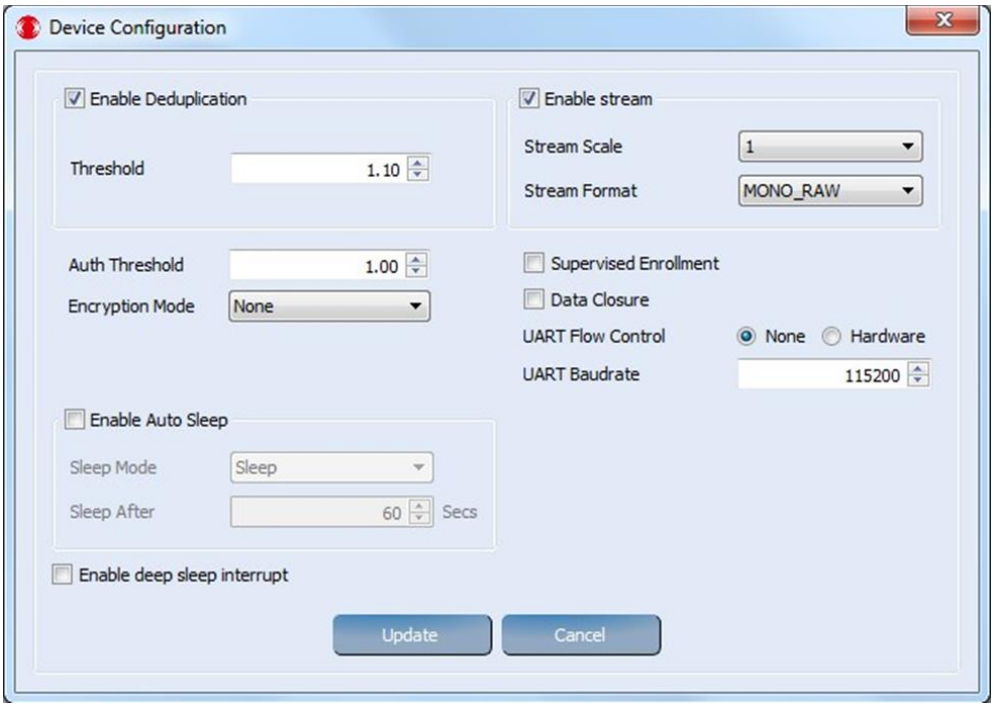
8.6.5 Lock/Unlock/Configure Device

8.6.5.1 Configure Device

1. Click "**Configuration**" to change the parameters of the device such as Threshold, Streaming, and Encryption.
2. Then, click "**Update**" to save the parameters.



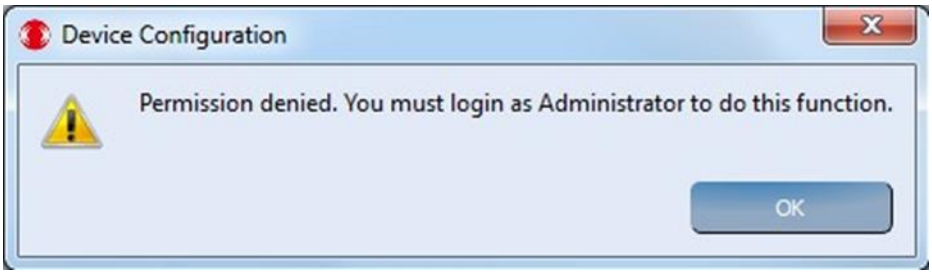


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Table 4 Descriptions of Parameters in Configuration Function

Function	Description
Enable Deduplication	When Enable Deduplication is selected, a Threshold value is required. This value should be larger than the Authentication Threshold. The default value of this Threshold is 1.10. This parameter is to enable the duplication checking during enrollment. The captured iris image will be compared to all enrolled iris data in the device. If all the matching distances are greater than the Deduplication Threshold, the image is allowed to be enrolled. Otherwise, a rejection message will be shown.
Enable Stream	If Enable Stream is selected, the streaming of iris image during capturing process will be displayed. The Streaming scale and Streaming image format options can be adjusted for better viewing.
Authentication Threshold	Authentication Threshold is used in the Matching processes (Verification and Identification). If the resulting matching distance is less than or equal to this value, a positive match is claimed. The default value of this threshold is 1.00 and should be less than the Deduplication Threshold.
Baud Rate	This parameter is to change the communication speed between IriShield and the host device. It is only used in case of IriShield™-UART and not applicable for IriShield™-USB.
Encryption Mode	When Encryption Mode is selected, all functions that get images and templates in non-encrypted formats will be disabled. Some of those functions, such as Capture, might result in "(Dev) Function Disabled" error.
Supervised Enrollment	If there is no SUPERUSER registered in the device, this parameter does nothing. Otherwise, a SUPERUSER must login to do the enrollment and unenrollment.
Data Closure	When Data Closure is selected, the application is not allowed to access iris images and templates in the device, leading to "(Dev) Function Disabled" error message in some functions, such as Capture.
Enable Auto Sleep	Device automatically goes into the selected sleepMode after a duration of sleepTimeout seconds has elapsed without incomming commands from host. If sleepTimeout is set to 0, device will NOT put itself into any sleep mode automatically after some idling time.
Enable deep sleep interrupt	Device automatically goes to deep sleep when detecting a falling edge on DS_input pin. Deep-sleeping device is waken up by the raising edge on the very same pin.

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8.6.5.2 Lock Device

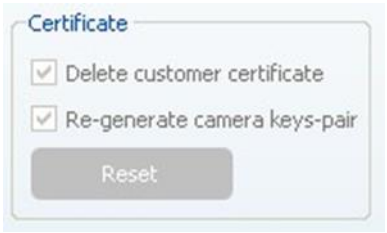
1. If at least one Admin user exists, an Admin user must login first.
2. Click "**Lock**" to lock the device.

8.6.5.3 Unlock Device

1. If at least one Admin user exists, an Admin user must login first.
2. Click "**Unlock**" to unlock the device.
3.

8.6.6 Certificate

Note: This function is not available in this version of IriSmartEye2000. However, it can be done if we use demo program in the sample code.



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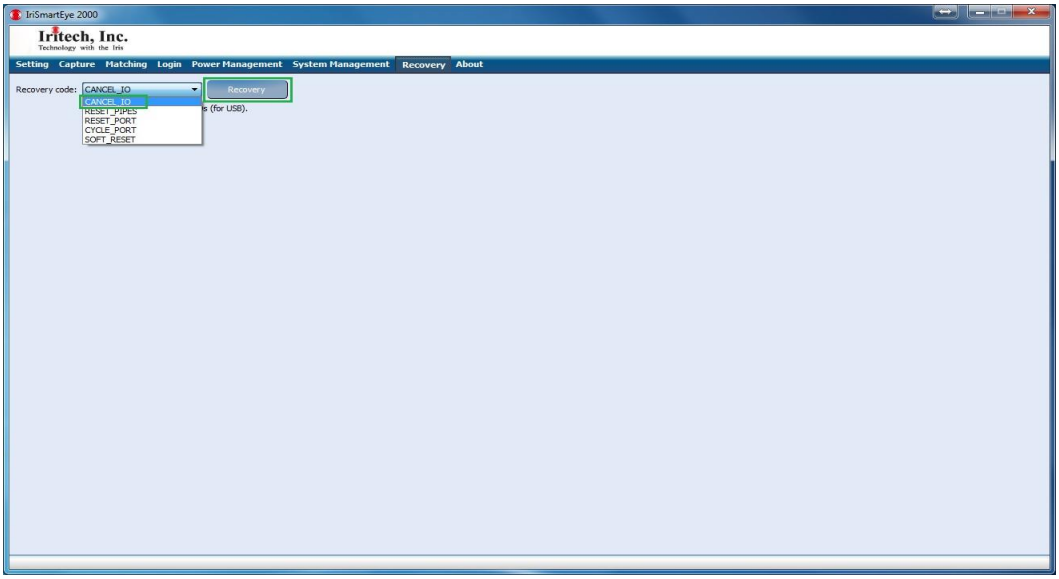
8.7 Recovery

IO failures occur when application tries to access an invalid device handle, of which happens when the device is hard-reset due to, e.g., power glitch or sufficiency. Application has closed the handle to device but tries to use it again. Especially, after a USB device goes into sleep mode, it is clock-lowered and any access before it awakes will result in IO failures. IO failures may also be due to version incompatibility among the device, the driver and the library.

To recover from a failure, it is recommended to unplug and plug the device again. However, in some cases where an operator or user is not available to do so, soft recovery approaches can be applied on the host device after waiting for around 10s. The soft recovery methods (found in IDDK2000 API) can be applied one or multiple times with increased severity levels.



- **CANCEL_IO**: This function is to cancel all pending IOs and clear internal buffers. When the failure occurs, the requested command execution is corrupted with invalid data. All the IO requests made for this command should be cancelled and invalid data should be discarded.
- **RESET_PIPES**: This function is to reset the USB pipes. To perform a command, there are several IN/OUT datas transferred between the host and the device. For example, the host first sends the request and waits for device's response whether it can execute that command. If so, the device changes its state to wait for input data. After receiving enough data, the device excecutes the command and sends the result to the host. In each step, the device has to wait for data or receipt acknowledgment from the host before it can proceed to the next step. If it cannot receive valid data after some time (around 10s), it has to halt data endpoints, drop the command, and wait for another command. Resetting USB pipes clears the halting conditions.
- **RESET_PORT**: This function is to reset the USB Port. If a reset on USB pipes does not help, try to reset USB port to get the device reset and re-enumerated.

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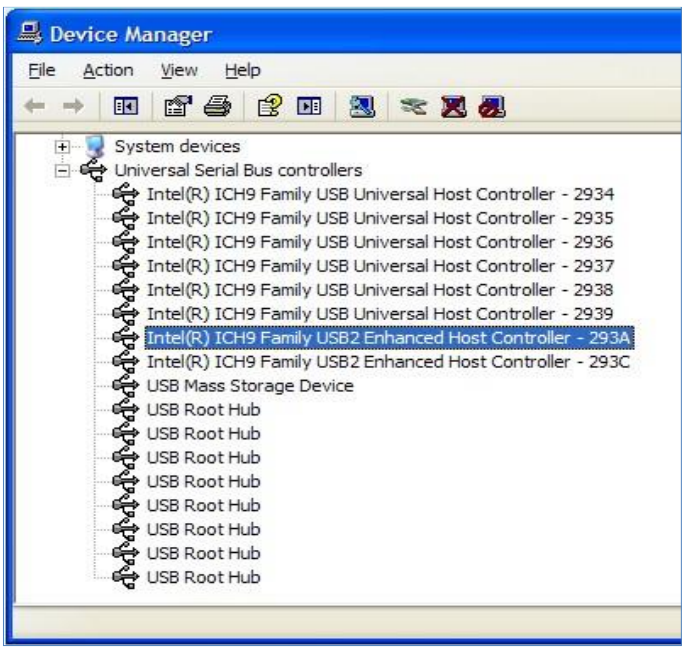
- **CYCLE_PORT**: This function is to power-cycle the USB Port. If a reset on USB port does not help, try this function. The device will seem like being unplugged and plugged back in, except that it is not electrically disconnected (firmware is not reloaded). The handle to the device will become invalid.
- **SOFT_RESET**: It is not a POR (Power-On Reset). Firmware is not reloaded. The processor only jumps to the execution of boot routine. Current states and data of the device are lost as if the device were powered off and then powered on again. Host receives a device removal notification and a device arrival notification when boot routine finishes.

Note that in Windows and Linux, IriShield's driver has taken care of the Recovery. The Recovery API is another attempt from application.

9. Cautions and Possible Problems on USB Cable and Port

9.1 Cautions

- IriShield™-USB camera should be used with the accompanied USB cable supplied by IriTech.
- The PC must be equipped with a USB 2.0 Host Adapter and a USB 2.0 port.
- You can verify the above conditions in the Device Manager provided by MS Windows. If there is "**Standard Extension PCI2 USB**", "**Enhanced**", or "**USB 2.0**" listed in the Universal Serial Bus controllers, it means the PC supports USB 2.0.



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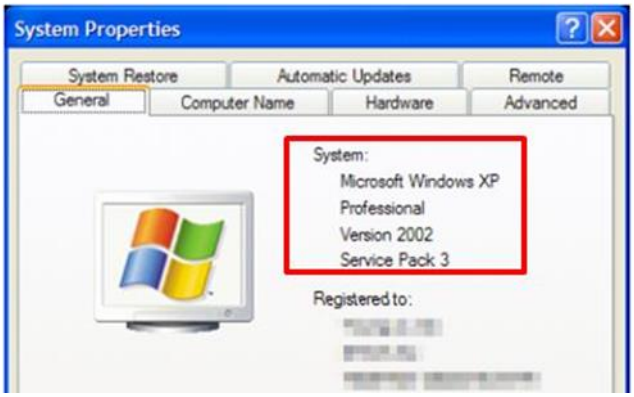
- Operating systems that support USB 2.0 include MS Windows Server 2003, MS Windows XP, and MS Windows 7. You can verify whether your operation system has the correct service pack. It should indicate later version than Service Pack 2. Please contact IriTech if other operating systems need be supported.



9.2 Possible Problems

We have encountered some computers with USB ports sloppily implemented. Make sure to use properly implemented USB ports. If you have any problems with USB connections, try the following suggestions:

- **Snug fit**

Some USB ports are loose that USB device cannot fit snugly into the port. In this case, due to the unstable connection, the device may stop working sporadically. Please try another, better-made USB port. (You may have experienced this problem even with flash memory stick.)

- **Missing USB Drivers or Incorrect Driver Versions**

Sometimes the problem is in the driver of the USB controller itself. By re-installing the USB driver on your PC, you might be able to resolve the issue.

- **Using Device Manager**

You can use *Add New Hardware* to detect USB device problems. In Windows XP, click Start Menu and choose Control Panel. Double click *Add New Hardware* icon. Let Windows run a scan of all devices on the system.

- **Mismatched Cable**

There are two types of USB cable: high speed and low speed. If you use the IriShield™-USB device with a low-speed cable, you can cause signal distortion over long distances. Please use the cable provided by IriTech.

- **Cable Length**

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The USB cable provided by IriTech is recommended. If other USB cables are used, please note that the USB cable length must be less than 1.5 m.

- **Remove and Reinstall all USB Controllers**

If the above mentioned suggestions do not help, try the following. Open the Device Manager, right-click on every device name under the Universal Serial Bus Controllers node, and then click Uninstall to remove them one at a time. Restart the computer, and then reinstall the USB controllers.

- **Remove Hubs**

An external hub is not allowed for use with the device. Please remove it. Note that some USB ports on the desktop are connected to mainboard like connecting to USB Hub. Please remove other USB devices if your desktop cannot recognize the IriShield™-USB device.

- **Reboot your system**

Turn off your computer using Shut Down and then unplug it from the wall outlet. Let it sit for about a minute and then plug it back in.

- **Other possible Solutions**

After plugging in the device, reboot the system. Normally this step would not be necessary, but there are times when it does help.

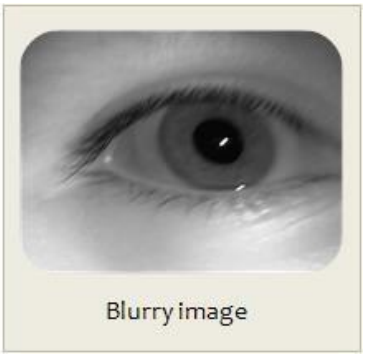
When you have tried all of the above suggestions and still find the device not working, please contact us by dialing +82-2-872-3812 or by email at *collaboration@iritech.com*. We are willing to support and help you in any situation.

10. Troubleshooting

10.1 Preventing Dark, Mismatching, or Blurry Images

Dark image

Mismatching image


Blurry image

Cause: The upper eyelid and eyelashes cover most of the iris.

Solutions:

- Check the LED angle to make sure it is positioned as described in Section 8.1.

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- Do not move quickly in front of the camera; instead, slowly approach the camera in its focus range.

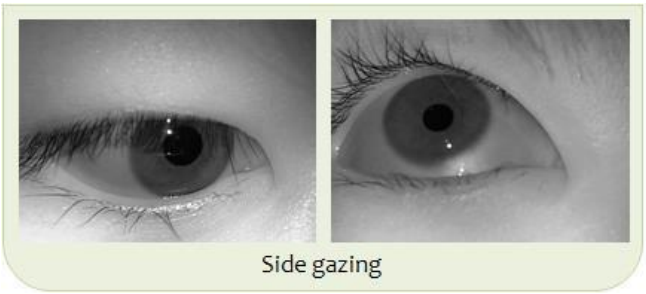
10.2 Preventing Occlusion

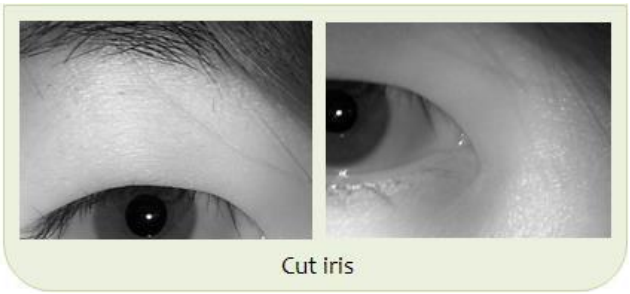
Cause: Infrared LED is not positioned correctly or the user moves too fast.

Solutions:

- Keep your eyes wide open while approaching the camera so the whole iris is visible in the image.

10.3 Preventing Side Gazing & Partial Iris





Cause: The user was not aligned properly with the camera or was looking to the side of the camera. Such images may result in capture failure or faulty iris recognition.

Solutions:

- The user should look straight ahead and make sure the eye appears in the center of the camera mirror. Closing the other eye may help with the alignment..

10.4 Device IO Failure

While the IriSmartEye2000 software and camera are active, a "Device IO Fail" error could occur.

Cause: The connection to the camera has been temporarily disconnected or has become unstable for the following reasons:

- If you closed a laptop computer and later reopened it.
- If the OS was switched to the Standby Power Saving Mode and later reactivated.
- If the camera was not a snug fit into the port due to a loose USB port.
  - ✓ Please try another, better-made USB port.
- If there was lack of sufficient current in one USB port that is branched out into two physical outlets.
  - ✓ You should disconnect the other device from the USB port.
- If you use an external hub.
  - ✓ Please remove it and try again.
- If you did not use the USB cable IriTech has provided.
  - ✓ The cables sent from IriTech are most suitable for IriTech products as impedance or shielding is well matched through multiple tests.

Refer to Section 0 to learn more about the problems with USB connection.

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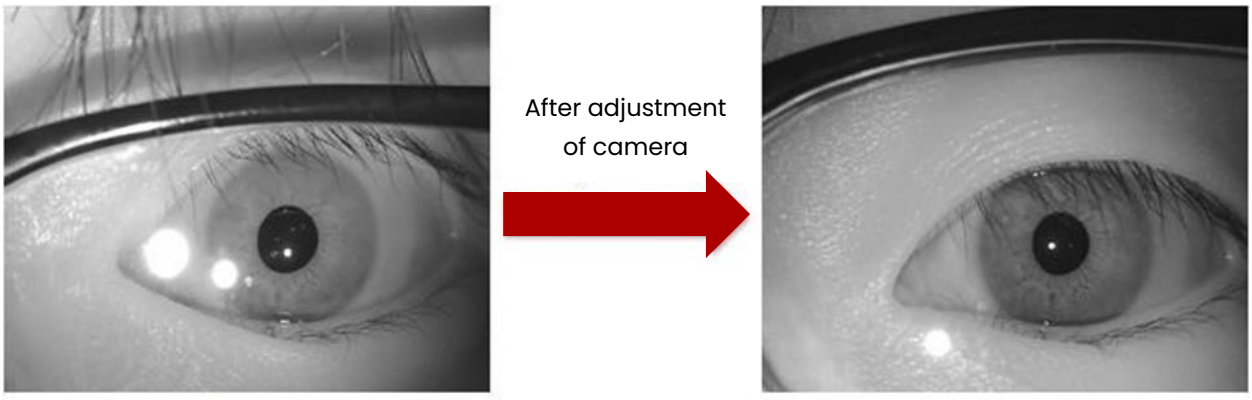
Solutions:

If a "**Device IO Fail**" error appears, click "**OK**." After a few seconds, the camera and the software will automatically reactivate and re-establish their connection. Click "**Start**" to operate the camera as normal. In case it does not reactivate, you can **reset by clicking "Reset" or use "Recovery" functions in IriSmartEye2000**. If the "Reset" button does not work, please unplug, then plug in the device manually and restart the application.

10.5 Preventing Reflection by Glasses



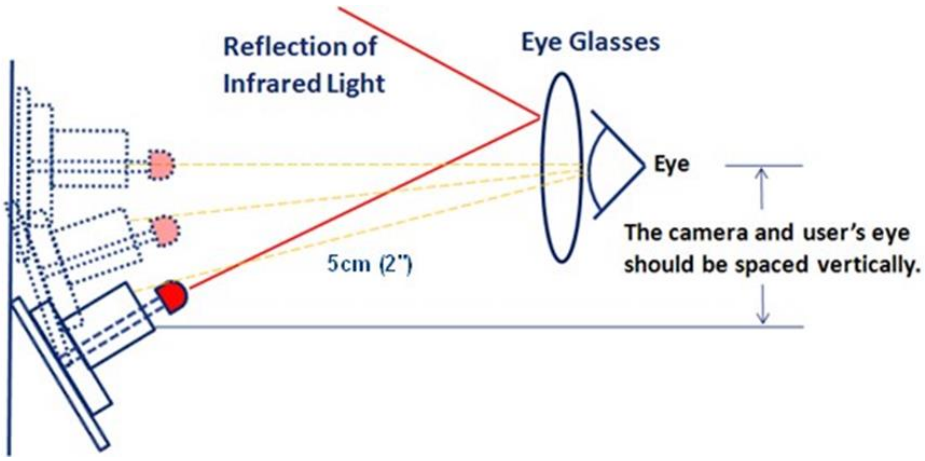
Strong LED reflection on glasses covers part of Iris

Reflection removed from iris through adjustment of camera

Cause: The infrared LED illumination is reflecting off from the user's glasses and back into the camera. This creates a bright glare that covers part of the iris in the image.

Solutions:

Adjust the infrared LED or the angle of the camera until this problem is minimized or disappears. Having the camera perfectly horizontal and parallel has the great tendency to cause a reflection. See the diagram below for guidance. Unfortunately, each type of glasses has a different shape, so it may not be possible to find an ideal adjustment for all users. We recommend the user to remove his/her eyeglasses during iris image acquisition, especially for enrollment.



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11. FAQ

11.1 Questions about the Camera Hardware

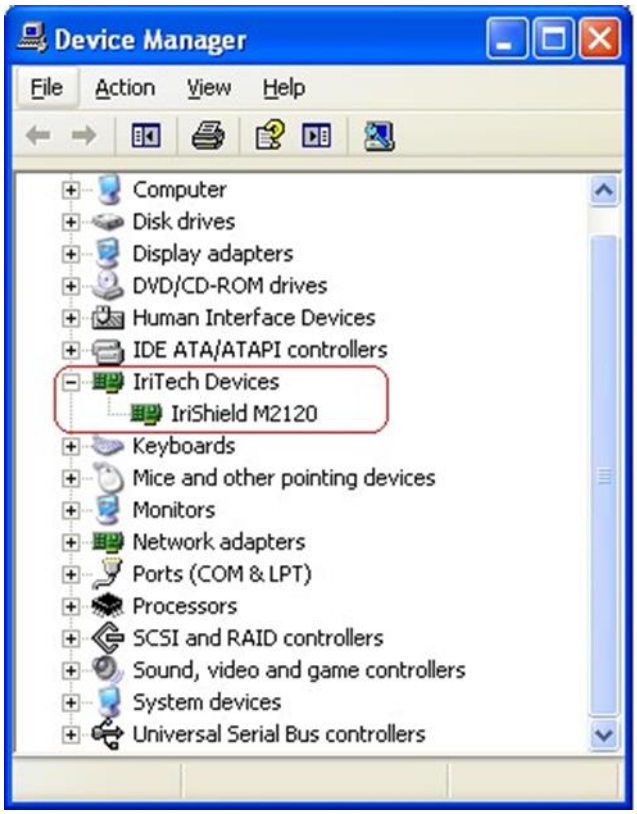
1. May I use a USB Hub to connect the camera to my PC?
   A. No, we do not recommend operating the device through a USB Hub.

2. How long may I operate the camera continuously?
   A. There is no limitation as long as the camera is used under normal conditions.

3. What atmospheric temperature is required for operating the camera?
   A. For operation: 0°C to +45°C, 10% to 90% humidity, non-condensing.

4. Is the infrared LED light of the camera harmful to the eyes?
   A. No, it emits very low infrared light (less than 2% of the LED Eye Safety Standard Regulation). It is harmless to human eyes, but it could lead to eye fatigue if the user has to stare at the camera for a long time. It is advised to capture iris images as quickly as possible.

5. How can I check if the camera is connected properly?
   A. You can verify the connection in the *Device Manager* provided by MS Windows. If no yellow mark is found next to the camera name (e.g., IriShield MK), the camera is connected properly.



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6. How can I put my eye in the focus range of the camera?
    A. Please refer to the Section *1*.

7. What if the image produced has spots or the appearance of dust?
    A. Examine the camera's mirror for dust or dirt. Clean the outside of the mirror with a cloth approved for optics. If this does not correct the problem, dust may have been trapped underneath the mirror (between the mirror and lens). The mirror will need to be carefully removed. Clean the lens and the mirror, then replace the mirror.

11.2 Questions about Software Installation

1. What kind of operating system is required?
    A. MS Windows XP 32bit with Service Pack 2 or later version, Windows 7 32bit, Linux 32bit, Embedded Linux, Android.

2. How can I check if the IriSmartEye2000 software is installed properly?
    A. Check if files are in the folder under the address "C:\Program Files\ IriTech\ IriSmartEye2000" (refer to Section *7.3 IriSmartEye2000 Installation*).

3. Even though the camera is connected to my PC, the driver is not found. What should I do?
    A. i. Disconnect the camera and plug in again.
    ii. Re-install the driver. If all the USB ports are connected to the same USB Host Controller, the first installation of the driver should be sufficient. If each USB port is connected to a separate USB Host Controller, the driver will need to be re-installed when an entirely new USB port is used.

4. How can I check if the software is completely deleted after I remove the IriSmartEye2000 program?
    A. Check if files are in the folder under the address "C:\Program Files\ IriTech\ IriSmartEye2000".

5. Does it matter if I install IriSmartEye2000 software before installing the driver?
    A. It should not matter which one is installed first.

11.3 Questions about Image and Template Files

1. Where is the captured image stored?
    A. C:\Program Files\ IriTech\IriSmartEye2000\Best
    (The "Best" folder is automatically generated once iris images are captured.)

2. Can users change the file in which the captured images are stored?
    A. No, this is not possible using the minimal functions available within the IriSmartEye2000 software. However, you can create your own Iris Recognition Application using the IriShield™-USB SDK (IDDK2000) to do that.

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3. Can users specify the image name that will be captured?
    A. No, this is not possible using the minimal functions available within the IriSmartEye2000 software. However, you can create your own Iris Recognition Application using the IriShield™-USB SDK (IDDK2000) to do that.
4. How many iris images can be stored using the IriSmartEye2000 software?
    A. There is no limitation on the number of images or templates stored for IriSmartEye2000 purposes on the Host PC. If you create your own Iris Recognition Application for commercial use or attempt to access other functionalities, certain restrictions may apply. However, the IriShield™-USB can store 1,000 templates in internal device memory (It can be extended up to 10,000 templates with a license).

5. How can I check how many persons have been registered?
    A. No, this is not possible using the minimal functions available within the IriSmartEye2000 software. However, you can create your own Iris Recognition Application using the IriShield™-USB SDK (IDDK2000).

6. What is a template?
    A. The iris template is a special biometric reference in which the iris features have been stored for the purpose of matching. Matching compares the stored iris template against the new iris features extracted from the recently captured iris image data.

7. Can users change the file in which templates are stored?
    A. No, this is not possible using the minimal functions available within the IriSmartEye2000 software. However, you can create your own Iris Recognition Application using the IriShield™-USB SDK (IDDK2000).

8. How long does it take to generate one template?
    A. No longer than one second.

9. Is there any limitation of length or special characters when users create IDs associated with an iris image?
    A. Special characters are not allowed, but there is no limitation of the length.

10. If I unenroll the wrong ID by mistake in the IriSmartEye2000 software, is there any way to restore the image?
    A. An image deleted by the IriSmartEye2000 software's Unenroll function cannot be restored.

11. If a user manually deletes the database file, will that achieve the same result as unenrolling all the registrations?
    A. Yes, it will achieve the same result as unenrolling all the registrations, but the IriSmartEye2000 software will need to be restarted before it will recognize the file as removed.

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11.4 Questions about the Image Capture Process

1. Can I capture high quality iris images if the user is wearing glasses or contact lenses?

    A. Glasses should not interfere with the image capture, but the iris pattern may be affected by glare off the glasses depending upon the situation. We recommend the removal of glasses, especially before enrollment. It is also possible to adjust the equipment as seen in Section *10.5 Preventing Reflection by Glasses* to improve the image quality.

    Soft contact lenses are not likely to cause problems. Hard contact lenses can create glare that covers part of the iris and make capture more difficult.

2. Is the iris affected by LASIK eye correction, or any other correction surgery, or by disease?

    A. Disease or surgery that covers or changes the iris pattern may interfere with iris recognition. However, most eye surgeries or diseases do not have these impacts. For example, LASIK eye correction should not cause any changes to the iris. An example of surgery that might cause challenges is intraocular implants. These implants are similar to wearing hard contact lenses and may cause glare that makes capture more difficult.

3. Why does the user have to move slowly forward during the capture procedure?

    A. To begin the capture, the user must be at the appropriate capture distance and in complete focus. Moving forward slowly is the best way to achieve the right distance.

4. Although the iris camera is installed indoors, there is a reflection on the iris image. What should I do?

    A. The problem may be caused by another source of light such as fluorescent bulbs, sunlight from a window, or the reflection from a mirror. Adjust the location of camera and/or user and try to capture the image again.

5. When I use the Time-Based option on the Capture Mode setting, what is the maximum time limitation?

    A. 600 seconds.

6. When I use the Frame-Based option on the Capture Mode setting, is there a time limit during the capture process?

    A. There is no time-limit in the IriSmartEye2000 program. However, the limitation of FrameBased value is 600 frames.

7. Is there a way to examine all the images captured during a particular capture process?

    A. No, only the best image is saved at the end of the capture process. For example, if you specified three frames in the Frame-Based option, the capture process will stop after it selects three qualified frames. It will then choose the best frame and save that to the computer. The other captured images will be discarded.

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Contact information

Headquarters

11166 Fairfax Boulevard,

Suite 302, Fairfax, VA

22030, USA

Tel: +1 703-877-2135

Fax: +1 703-877-2136

South Koreo office

A-801, Daesung Dipolis Knowledge Industry Center, 606, Seobusaet-gil, Geumcheon-gu, Seoul 08504, KOREA

Tel: +82 2-872-3812

Fax: +82 2-872-3815

Viet Nam office

3th Floor, VP1-03, BCONS TOWER Building, 176/1 - 176/3 Nguyen Van Thuong St., Ward 25, Binh Thanh District, Ho Chi Minh City, Vietnam. Tel: +84 8-6297-9480

India office

320, Raheja Arcade, Koramangala, Bangalore - 560095

Landline: +91 80-41643057

Phone: +91 98-45025278

Get in touch

Email: info@iritech.com

Website: www.iritech.com

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