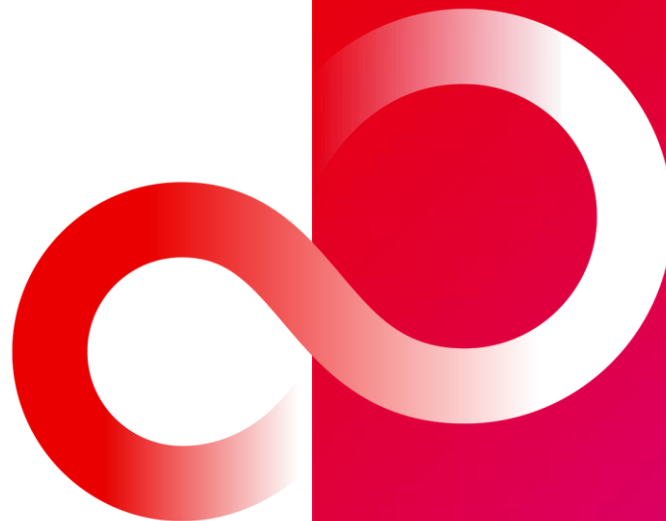


Cashier Fraud Monitoring User's Manual

2024/2/9

Fujitsu Limited

Fujitsu Research



Revision History



Date	Edition number	Content of the revised edition
2024/2/9	1.0	New

- Overview
- How to use

Overview

What Can and Cannot be done in the Current Cashier Fraud Monitoring Component

- What can be done

- By analyzing the video taken from above the self-checkout counter, you will deepen your understanding of the input/output and detection accuracy of Cashier Fraud Monitoring technology and examine the applicability of the technology.

- What cannot be done

- The current component does not support online processing operation based on camera input, linkage with the POS system, and notification, and cannot verify operation in cooperation with the system of the real store.

*If you would like to demonstrate using the above functions, please consult with us individually.

Overview of Cashier Fraud Monitoring and Status of Response to Current Component

- Cashier fraud monitoring: Detects various fraud in self-checkout counter.

Scan at a self-checkout counter

Occurrence of scan avoidance :

Scan Avoidance Detection

Technology to detect scan avoidance by recognizing items held in the hand during scanning operations.

Disguising scanned items:

Item Category Recognition

Technology to detect fraud in disguising scanned items by recognizing categories from the appearance of items.

Account at the self-checkout counter

Leave unscanned items in basket:

Remained Items Detection

Technology to detect fraud of leaving unscanned items in a basket by detecting items in the basket.



Only "Scan Avoidance Detection" is supported in the current component. However, "Angle Change Detection*" is also available as an operation support technology.

*Angle Change Detection: A technology that detects changes in the angle of view of images in order to prevent degradation in the accuracy of image analysis during operation.

● Input-output

● Input:

- Video taken from above the self-checkout counter during item scanning
 - You can select the sample video and upload your video ([conditions](#)).
- Start and end times of item scanning, Number of items scanned
 - It is assumed that these can be automatically acquired by linking with the POS system, but the current component does not support linking.
 - These were set for the sample video.

● Settings

- Area for placing items before scanning (ROI), area for placing items after scanning (ROI)
 - ROI: Region of Interest. Here, an area is used for counting the number of items brought to the self-checkout counter.
- detection threshold*option

● Output

- Detection result of item scan avoidance.

● Method

- The system analyzes the input video, estimates the number of items brought to the self-checkout counter, and compares it with the number of items scanned to detect scan avoidance of items.
 - If $(\text{Number of items brought in (estimated)}) - (\text{Number of items scanned}) \geq (\text{Detection threshold})$, it is detected that there is a scan avoidance.
 - The detection threshold can also be changed on the component. When the detection threshold is increased, detection avoidance occurs, while false detection can be reduced.
- The number of items brought in is estimated by counting the movement of taking out the items from the area for placing items before scanning and putting the items into the area for placing items after scanning.



The number of items brought in is estimated by counting the movement of taking out the items from the area for placing items before scanning and putting the items into the area for placing items after scanning.

- Supplement

- While this technology is based on AI technology and does not require special hardware, **it is difficult in principle to accurately detect all cases**. Under such circumstances, this technology has been developed with the aim of sufficiently suppressing false detection and enabling detection when fraud is strongly suspected, in order to suppress trouble caused by false detection.
- The accuracy of the uploaded video may not be sufficient depending on the conditions such as the type of cashier, basket (colors, patterns, shapes), lighting, angle of view, etc. However, the accuracy may be improved by constructing the learning data based on the video of the same condition and having it relearn. (Not supported by current component)

- Common conditions for scan avoidance detection and angle change detection

[Required]

- Format: mp4 (H.264)
- Upper bound of size: 500 MB
- Resolution: 1920 x 1080
- Frame Rate: 10 fps
- Terms of use must be satisfied.
Note) It may result in loss of accuracy to apply mosaicing or other processing to the faces in the input video to prevent personal information from being included in the input video.
Please contact us if you want to verify for the input video with personal information.

- Conditions for scan avoidance detection

[Recommended]

- Camera conditions to be used for recording videos
 - Features: white balance, anti-flicker
 - Shutter speed: 1/500 sec or less
- Video content
 - Scene: Start of item scanning to End of scanning (Press the scan start button to Press End button on the POS screen)
 - Specify the start and end times in the component.
 - Angle of view: As shown in the upper right image
 - The camera is mounted directly above the center of the self-checkout counter in the direction of looking down, and shows a person's shoulders, arms, torso, legs, and objects held by the person.
 - Person to be reflected at the top of the screen and the self-checkout counter to be reflected at the bottom of the screen.
 - The width of a person is 1/4 to 1/2 of the width of the image.



- Conditions for angle change detection

[Recommended]

- No person is existed in the first image frame.

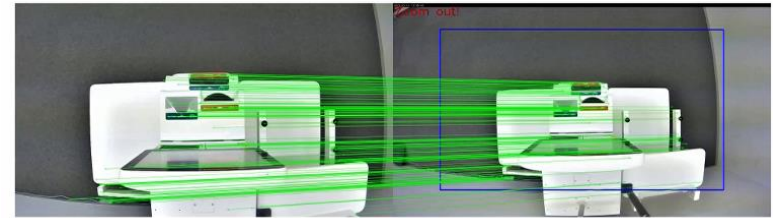
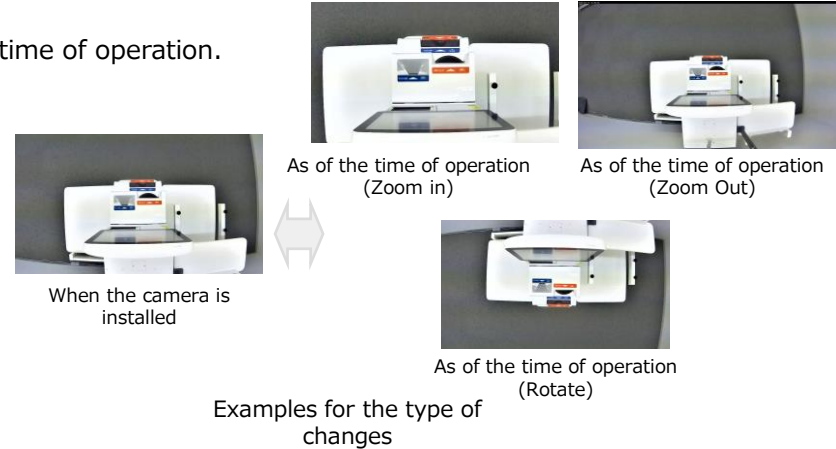
Angle Change Detection

● Input-output

- Input: Video at the time of camera installation and current video at the time of operation.
 - You can select from sample videos and upload videos.
 - Upload video conditions: The video format is the [same as the conditions of scan avoidance detection](#). No person is existed in the first image frame.
- Output: Detection results of camera angle change
 - Changes
 - Zoom In
 - Zoom Out
 - Rotate
 - Layout change · Relocate (The camera is located in a completely different location, or surrounding objects are different.)
 - No change

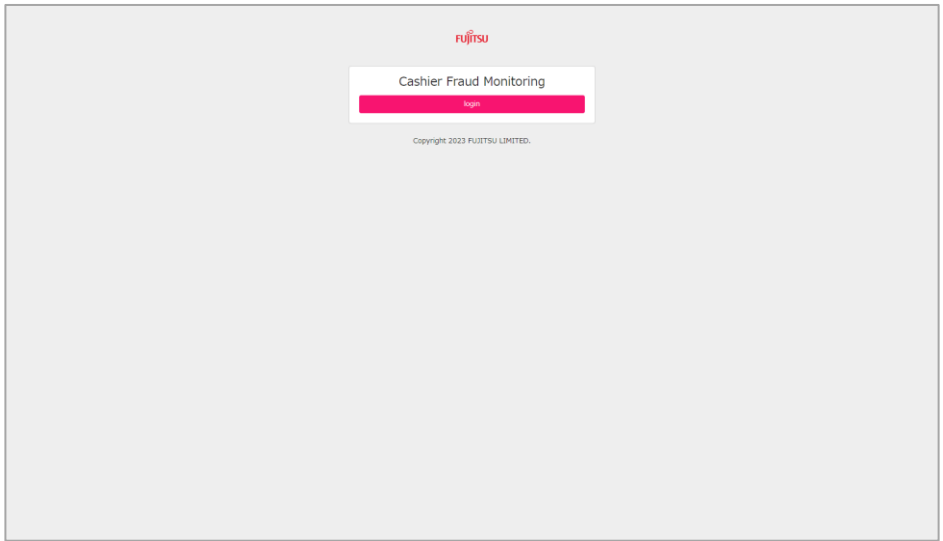
● Method

- The first image frame is extracted from each of the two videos.
- Detects a change in the angle of view of a camera by capturing the correspondence of feature points in two extracted images.



How to use

- Please log in with your account of Fujitsu Research Portal



- Select one of Scan Avoidance Detection and Angle Change Detection.
 - If you select “Scan Avoidance Detection”, follow the instructions [here](#).
 - If you select “Angle Change Detection”, follow the instructions [here](#).



Scan Avoidance Detection – Select How to Set Input Video

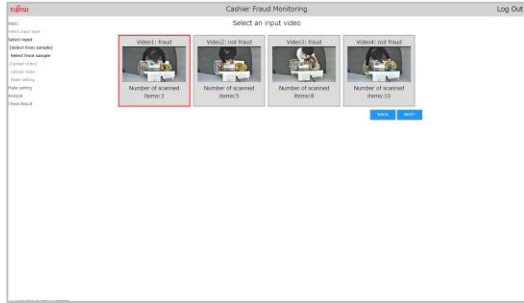
- Please select if using sample video (USE A SAMPLE VIDEO) or uploading video (UPLOAD A VIDEO).

The screenshot shows a web interface for 'Cashier Fraud Monitoring'. The top navigation bar includes the Fujitsu logo, the title 'Cashier Fraud Monitoring', and a 'Log Out' link. On the left, a vertical sidebar lists the following steps: 'Steps:', 'Select input type', 'Select input', '[Select from sample]', 'Select from sample', '[Upload video]', 'Upload video', 'Make setting', 'Make setting', 'Analyze', and 'Check Result'. The main content area is titled 'Select input type' and contains three buttons: two pink buttons labeled 'USE A SAMPLE VIDEO' and 'UPLOAD A VIDEO', and one blue 'BACK' button.

Scan Avoidance Detection – Input Video Settings

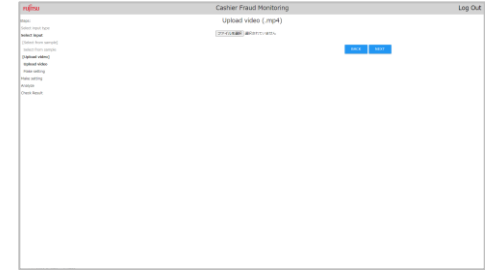
[When using sample videos]

- Please select the input video from the sample videos.

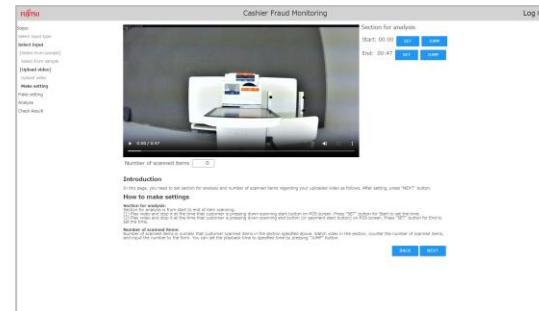


[When uploading a video]

- Please select a video to upload.

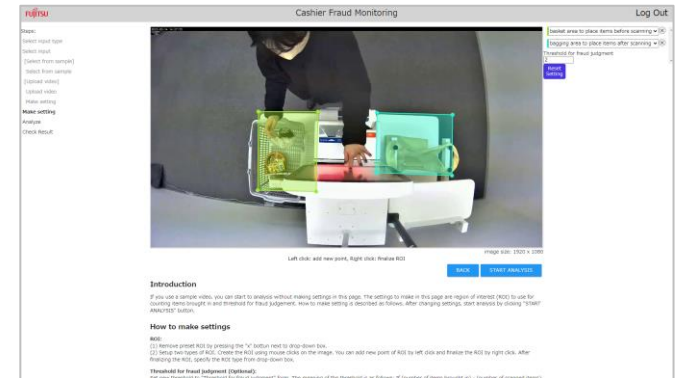


- Set the start and end times of the target scene and the number of items scanned.
 - The target scene is from the start to the end of item scanning (from pressing down the start button to the pressing down of end button on the POS screen).
 - Set the seek bar of the video according to the start time (end time) and press the SET button. Press the Jump button to move to the set time.
 - Enter the number of items scanned by visually checking the video from the start time to the end time of the target scene.



Scan Avoidance Detection – Settings

- Set the area for placing items before scanning (ROI) and the area for placing items after scanning (ROI), then press the "START ANALYSIS" button to start analysis.
 - If you select a sample video, the appropriate ROI is already set, so you can press the "START ANALYSIS" button to start the analysis.
 - See the next page for details on how to set up ROI.
 - The following features are available as required.
 - Changing the detection threshold (optional)
 - Detection rules in the "Threshold for fraud judgement" form: You can change the detection threshold for "Number of items brought in (estimated) - Number of items scanned \geq Detection threshold".
 - Detection avoidance increases by increasing the detection threshold, but false detection can be suppressed.
 - Reset Settings
 - The "Reset Setting" button resets the ROI and detection thresholds to their default values.



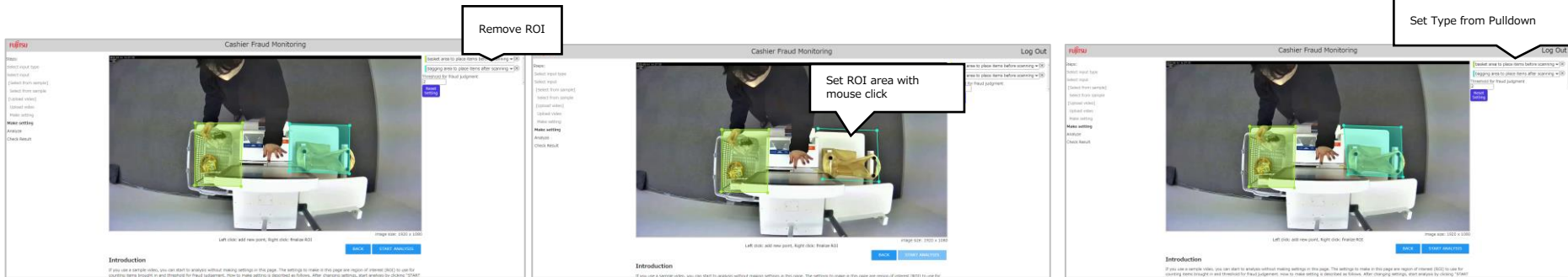
Scan Avoidance Detection – Settings (How to Set ROI)

● Overview

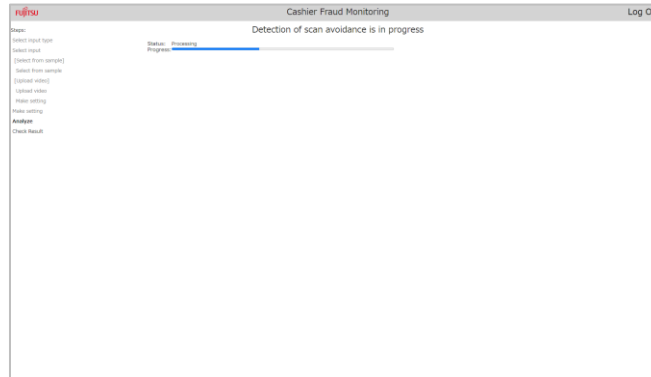
- Set two types of ROI for the “basket area to place items before scanning” and the “bagging area to place items after scanning”.
- Regardless of the input video, the ROI has a fixed initial setting as a sample and can be reset if necessary.

● Details

- Remove the sample ROI by pressing the "x" button.
- Set the ROI area by clicking the mouse in the image and set the type from the pull-down.
 - Left click to add a new point to the ROI area and right click to determine the area.
 - Add new points in clockwise order (If there are 4 points, the order is upper left, upper right, lower right and lower left.).
 - At least three points are required to determine the area.



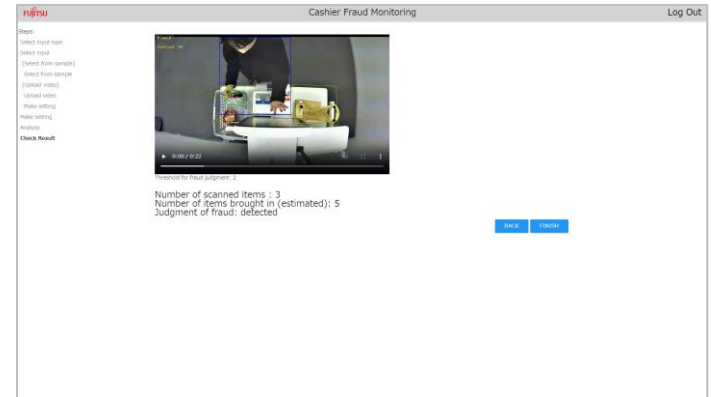
- This screen is displayed during analysis. Please wait for a while without operating.
 - This takes slightly longer than the length of the input video.
 - If another user starts the analysis before, status becomes pending.
 - If too many users are pending, an error may occur, and analysis cannot be started. If this happens, wait a while and try again.
 - If the input video you enter is too long (5 minutes or longer), it may take a long time to analyze and you may fail to analyze it. If this happens, shorten the video and try again.



Note) In actual application, since the online operation mode can be used, it can be linked with other systems without a long wait time.

Scan Avoidance Detection – Review Results

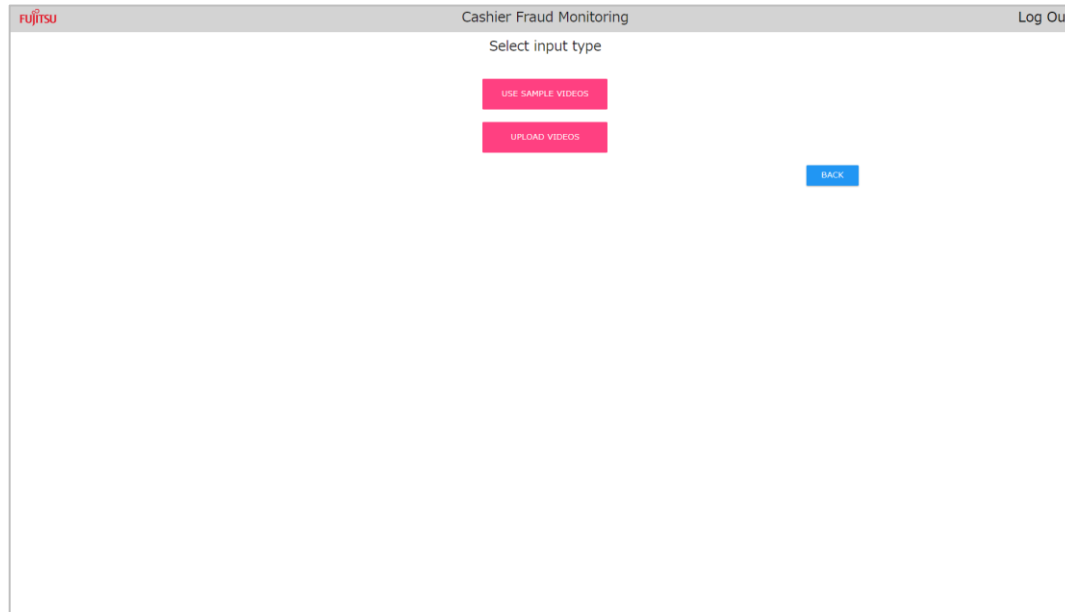
- Please check the results.
 - "Num of registered items" refers to the number of items scanned.
 - "Num of items brought in (estimated)" is the estimated number of items brought in.
 - "Judgment of fraud" refers to the detection result of a scan avoidance (fraud).
 - Fraud was detected . . . Scan avoidance (fraud) was detected.
 - Fraud was not detected . . . No scan avoidance (fraud) was detected.
- Use the following functions as required.
 - If you press the "FINISH" button, the screen for selecting the usage technology returns.



Angle Change Detection – Select How to Set the Input Video

* This screen is displayed when angle change detection is selected on the screen for application technology selection.

- Please choose to use sample videos (SELECT SAMPLE VIDEOS) or upload videos (UPLOAD VIDEOS).



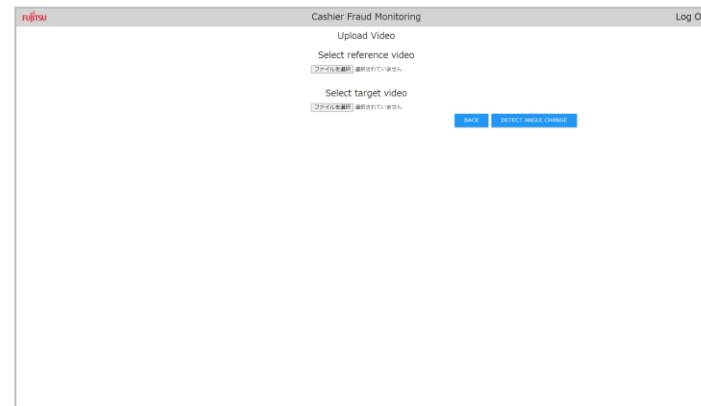
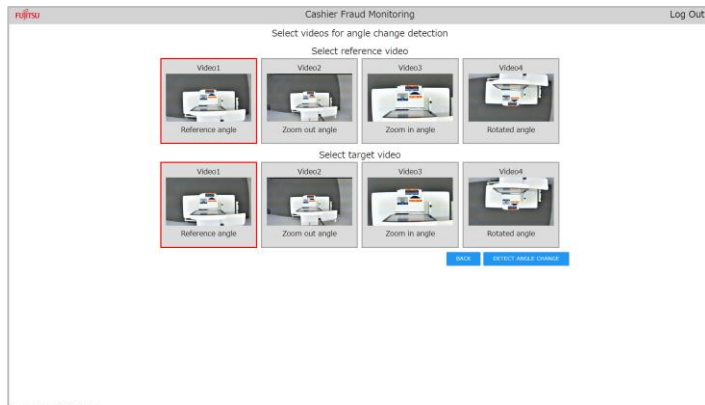
Angle Change Detection – Set Input Video

[When using sample videos]

- Please select videos at the time of camera installation (reference video) and current videos at the time of operations (target video) from the sample video, respectively.
- After selecting videos, press the detection button (DETECT ANGLE CHANGE) to start the detection process.

[When uploading a video]

- Please upload the video (reference video) when the camera is installed and the current video (target video) when it is operating, respectively.
- After uploading videos, press the detection button (DETECT ANGLE CHANGE) to start the detection process.



- Please check the results.
 - Reference image: The first frame image of the video when the camera is installed.
 - Target Image: First frame image of the current video at the time of operations.
 - Result of Angle Change Detection: Detection results of angle of view change.
 - Changed . . . The angle of view has changed.
 - The camera image is zoomed in. . . . Zoom In
 - The camera image is zoomed out. . . . Zoom Out
 - The camera image is rotating. . . . Rotate
 - The camera has been moved to a different location.
 - . . . Layout change . Relocate (The camera is located in a completely different location, or surrounding objects are different.)
 - Not Changed . . . The angle of view has not changed.- Press the "FINISH" button to return to the screen for application technology selection.



Thank you.

