

COMPACT VISION SYSTEM

SENSORS AND DIGITIZATION EXPERIMENT NO 4

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Objective

The goal of this practical lab is to study the applications of a Compact Vision System from Keyence and the software that the manufacturer provides. This experiment suggests to recognize the edge detection and to calculate the area of different objects.

Introduction

Computer vision system is mostly used to detect edges and to recognize different objects with respect to size and shape. This kind of system is mostly observed at security checkup at airport, where they scan the suitcase with respect to the door room to identify the objects. In our scenario we have used to detect the edges of the series of shafts placed with the backlight and then it was advanced to recognize the perfume cap and to find the area of it. The results are tabulated and pictured at different stages with the camera and the monitor setup.

Equipment

For the proper realization of the experiments, it is being used:

- Controller unit (CV-2100)
- Remote control console (OP-42342)
- Monitor cable (RCA – RCA, 2m)
- Camera (CV-020)
- CV-C3: Camera cable (3 m)
- Monitor CA-MN80
- 24V DC power supply
- Industrial Parts
- Backlight

Installation

The first step is to connect all the required cables and monitor as in figure 1. The real time picture is pictured below. Once the cables are connected properly turn on the power supply to all the devices like Monitor Controller unit, 24V DC power supply and camera. Check for the calibration of camera on monitor with different objects with the presence of backlight. Once the setup is properly arranged start grabbing the images.

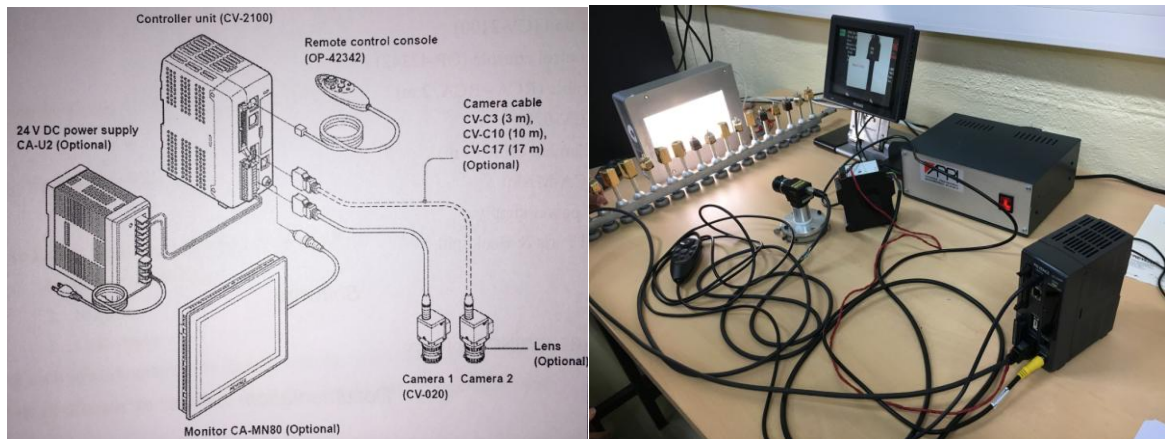


Figure 1. Installation setup

We can appreciate that the first sample object is shown properly on the screen of the Keyence machine in the figure 2. The two images shown below are one in real setup and on the Keyence monitor (left image).

It is important to realize that with a rear-illumination the experiment keeps functional to recognize different shapes of objects with more precision. So, backlight plays the vital role to include.

To get a satisfactory image, we have supported ourselves on the official manual that Keyence provides (chapter 4.2).

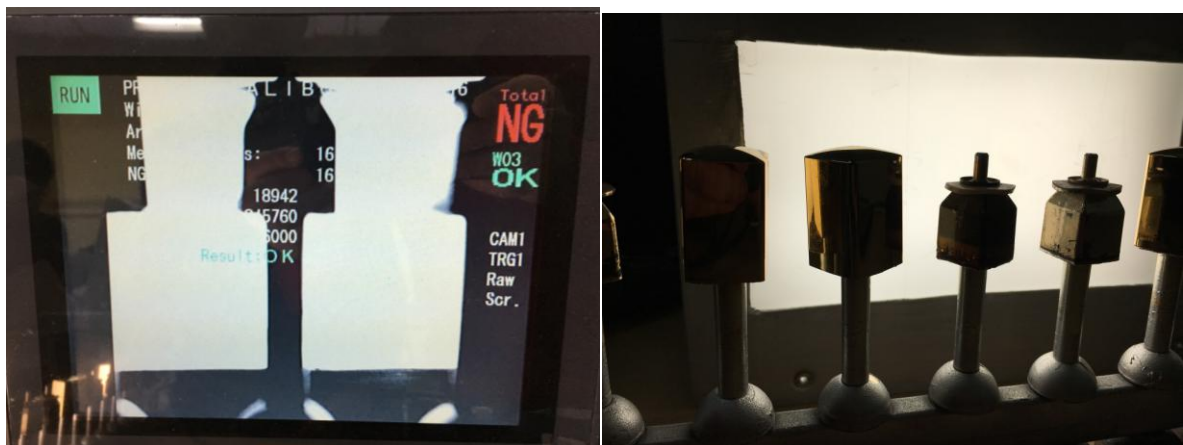


Figure 2. Objects on Keyence machine

Edge Detection

The aim of this section is to acquire edge detection of different shapes of objects by practicing to set up the programs designed for Keyence software.

The first objective is to be able to program edge detection in order to characterize the holder width on the industrial part. For that purpose, it is essential to follow carefully the

instructions of the official manual. The main reference that we will have for understanding the solution that is required is the one in the figure 3.

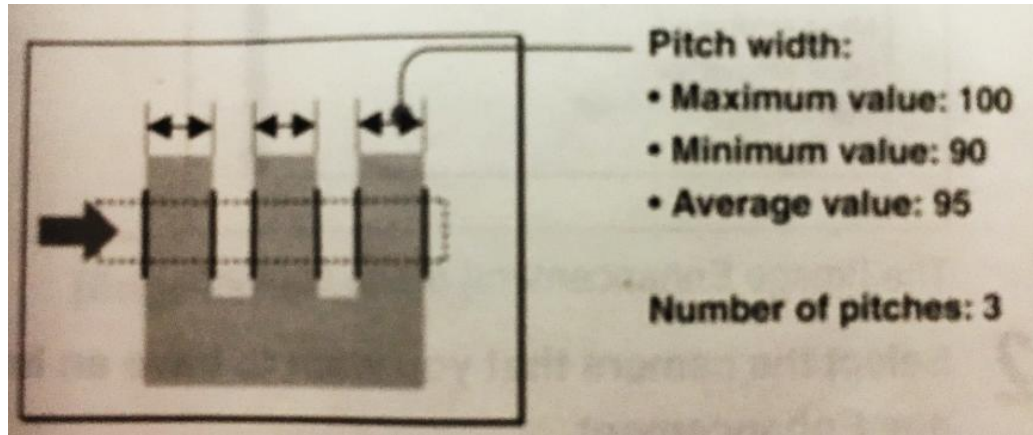


Figure 3 Edge detection labeling pitches

Below we detail the steps to do to carry out with the above said implementation:

Selecting the measurement tool:

- 1- Selecting the measurement window
- 2- Inside “measure” select “Edge pitch”
- 3- Inside “pitch” select “Gap pitch”

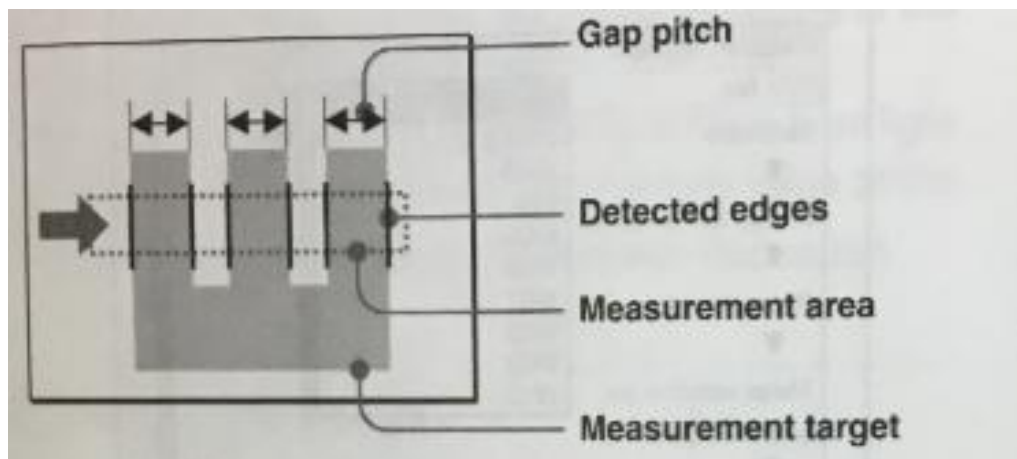


Figure 4 Edge detection labeling area

Selecting an image enhancer:

- 4- Inside “image enhance” select the camera in which you want to perform enhancement (camera 1 in our case)
- 5- Select the pre-processing number and the technique you want to apply (averaging in our case, where intensity is averaged to remove noise)

Selecting the measurement area:

- 6- Inside “Meas window” select the rectangle shape
- 7- Now the area of measurement has to be drawn

Selecting the detection direction:

- 8- Inside “select dir” select the option “from left to right”.
- 9- Inside “edge dir” select “both” so it will detect transitions from light to dark and vice versa.

Selecting the detecting conditions:

- 10- Inside “edge filter” specify the necessary conditions, which come from default as 255 for upper limit and 5 for lower limit.

Once all this steps have been computed, we are able to perform the detection:

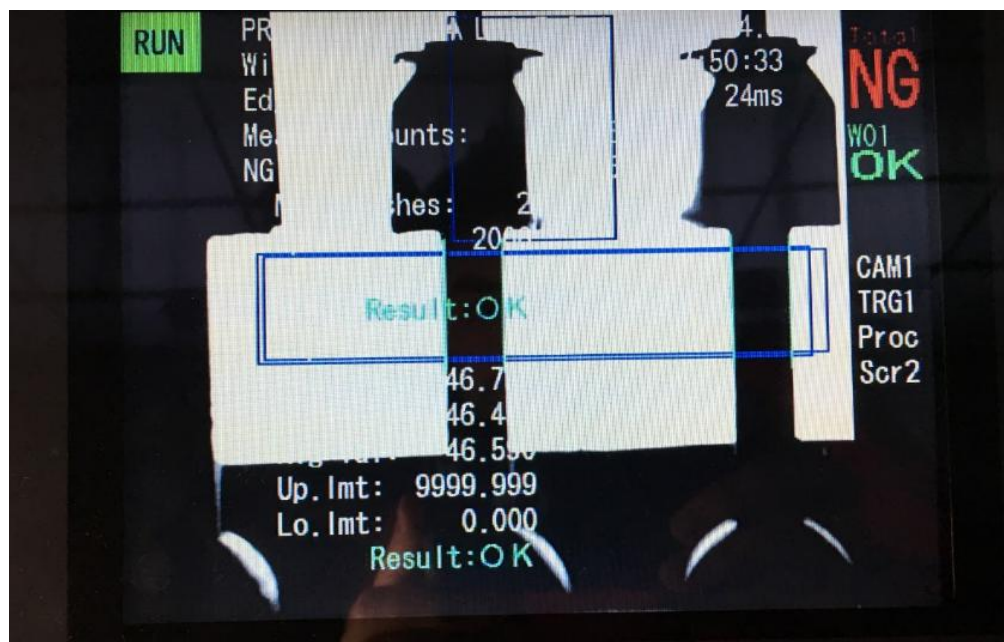


Figure 5 Edge detection by Keyence software

As it is seen, green lines appear in the edges of the holders. Also, the number of holders detected is automatically computed (we can appreciate the number 2 inside the shadow of the first object), as well as their diameter (46.7 mm).

Nevertheless, there is nothing perfect, and as may be obvious, our setup can be easily manipulated externally. That's why in an industrial level this machine should be encapsulated properly. An example of that is seen in figure 6, where an inserted pen confuses the machine, recognizing it as another holder, when it is not.

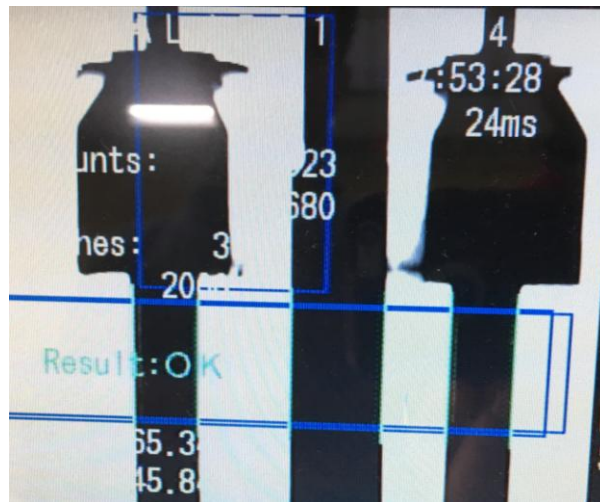


Figure 6 Edge detection by Keyence software for pen

Caps Detection

The last part of the experiment is to detect the perfume caps among different shapes of objects. We will consider having an array of objects. We will center our attention to the prismatic cap to find the shape and area.

We must ensure that our measurement shape is a rectangle. For achieving this, we follow again the reference manual of Keyence as mention above steps for the edge detection.

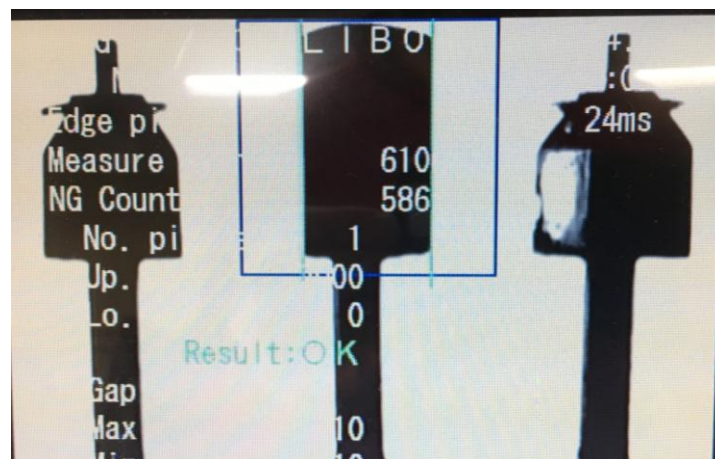


Figure 7 Caps detection by Keyence software

As we can see, the cap is recognized satisfactorily. We also added the feature that the area of the section visualized is computed: The areas for the given sample object was 17705

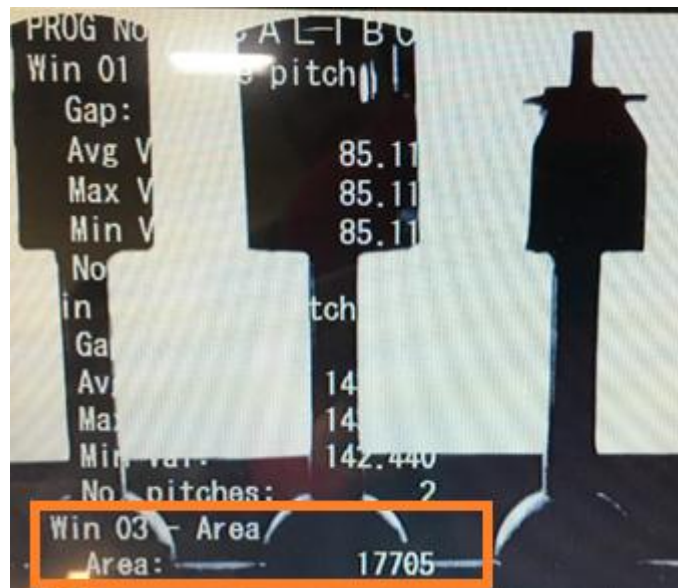


Figure 8 Labeling by Keyence software

Note that the green rectangle disappears, and the area is larger than expected. This could mean that the software is computing the area of the total image and not only the area of the cap.

Conclusion

We have conducted edge and caps detection for different shapes of objects in presence of backlight with all the required setup and Keyence software. The results are discussed and labeled with pictures.