Acquisition Practical

Labs 3 - Lens & Lighting

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Introduction

Lens is a piece of transparent material such as glass that has two opposite regular surfaces either both curved or one curved and the other plane and that is used either singly or combined in an optical instrument for forming an image by focusing rays of light.
Light is a very importante in machine vision. The goal of lighting is to obtain a robust application by enhancing the features to be inspected and by assuring high repeatability in image quality. The color of the visible light change in respect to its wavelenght.

Objectives

The goal of this pratical work is to study the influence and characteristics of multiple lenses and lighting systems on the image aquired by the camera. In the first time we will test the different lenses able to capture the all scene. Give our conclusion on camera link standard, make test using extension ring adn finally using different lighting sytems and study all the hole and scratches on the object suface.

Chapter 1

Lens

1.1 Choose the right lens

The objective in this part of the lab is to choose the right lens to be able to capture the all scene.
After testing the different lens available we choose the only one able to observe the fork in order to perform surface inspection with a working distance of 500 mm.

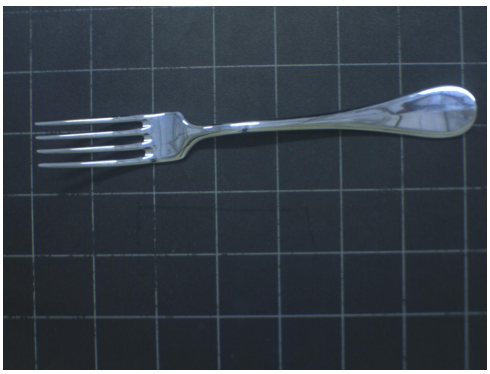

Figure 1.1: Choosing the right lens

Explanation: We choose the lens of 8mm with an basic extension ring on the camera of 5mm. The image amove is the result obtained by the camera using the 8mm lens.

1.2 Spatial resolution

The resolution of a CCD is a function of the number of pixels and their size relative to the projected images.

Definition: Spatial resolution is the number of pixels utilized in construction of an x-ray digital image. For example, X-ray images having higher spatial resolution have a greater pixel count. Higher spatial resolution have a sharper detail like high definition but has missing pixels on the image. However, those x-ray images that have lower spatial resolution have a dull detail but has more pixels present on its image.

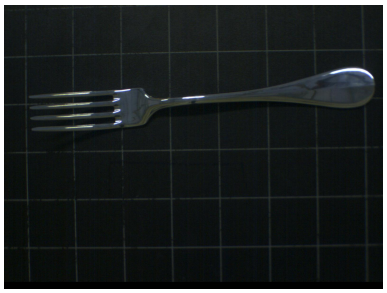

Figure 1.2: Changing the value of the pixel clock to 43

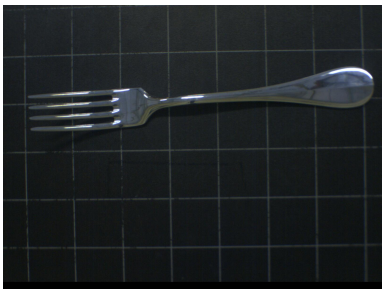

Figure 1.3: Changing the value of the pixel clock to 30

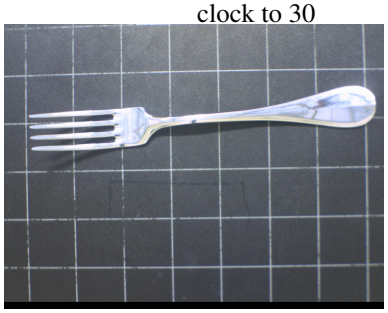

Figure 1.4: Changing the value of the pixel clock to 5

1.3 Extension rings

During this experiement we realize by adding extension greater that 5mm the camera is not able to provide any images showing the object or at least the shape of this one.
So our conclusion of using extension ring is that this extension should not be greater than 5mm , but need to bo at least 5mm. As you can see in the 3 figures below.

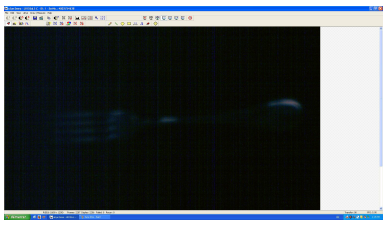

Figure 1.5: No extension ring

Figure 1.6: With an extension ring of 20 mm

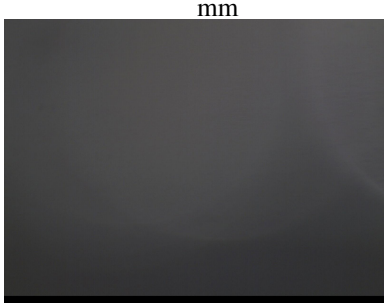

Figure 1.7: With an extension of 30 mm

Chapter 2

Lighting

2.1 Part N°1 - Silhouette analysis

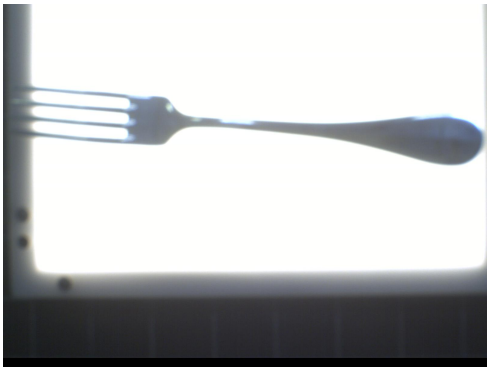

Figure 2.1: Image using the 8mm lens at 50 cm working distance

Explanation: As you can see in the figure above we were able to show the contours of the object, keeping the same working distance of 50 cm and using the 8mm lens and also performing the all surface of inspection of the object.

2.2 Part N°2 - Defect detection on shiny surface

Figure 2.2: Hole observed on the fork

Figure 2.3: Scratches at 46 cm distance

Explanations: Using a different lens of 25 mm this time we were able to observe the different holes and scratches present on the surface of the object analyzed.

Chapter 3

Lab Bonus - Surface Inspection

Figure 3.1: Detection using coins as object

Explanations: Detectors are used to measure the illumination of a light source for a number of optical or spectrometry applications. Detectors consist of arrays of photodiodes or photodetectors that transmit eletrical current when excited by collision from photons. Detectors enable measurement of important light characteristics taht are not conveniently acquired in the other ways.

Chapter 4

Conclusion

To conclude during this practical work we were able to configure the light and implement the scene needed by choosing the right lens. Also we observe that the choice of the lens is very imortant depending on the detail we want to observe and that the light have a effect on the resulted image.

References

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- **EO Edmud** https://www.edmundoptics.com/resources/application-notes/imaging/resolution/
- **Spatial Resolution** http://www.andor.com/learning-academy/ccd-spatial-resolution-understanding-spatial
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