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Vision System Setup

ME-CAE/2019

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Based on:

NI Vision Assistant Tutorial

June 2011 372228M

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Vision system setup:

The vision system should create an image of the object of sufficiently good quality so that it is possible to unequivocally obtain the necessary information about the object from the image.

The system does not have to be extremely „equipped" !!!

Five parameters affect the overall image quality:

- resolution,
- contrast,
- the depth of the object,
- perspective,
- distortion.

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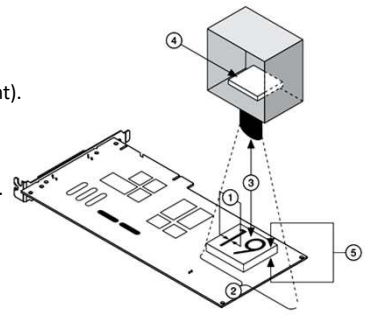
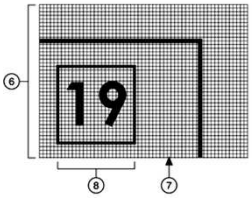
Vision system setup:

1. **Object resolution**: the smallest element that must be recognized by the system (expressed in units of measurement).
2. **Observation field**: the area of the object that can be observed by the system.
3. **Working distance**: distance of the camera from the object.
4. **Matrix**: sensor with a specific size and resolution.
5. **Depth of the object**: difference between the heights of observed objects.
6. **Picture**.
7. **Pixel**.
8. **Image resolution**: the number of pixels making up the image.





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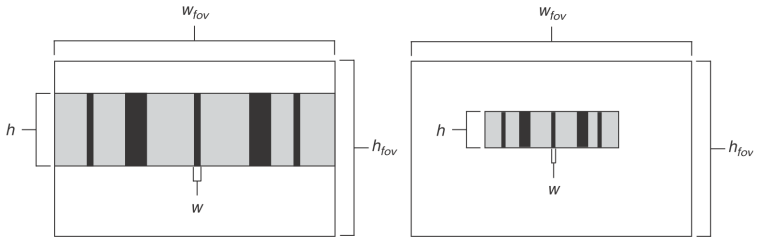
Vision system setup:

Resolution: the size of the smallest object. Actual objects (e.g. the minimum width of the code bar) can be represented by elements of the image of different sizes - the parameter in the figure below.



For **the measurement to be correct**, the **smallest element** should be represented on **at least 2 pixels**.

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Vision system setup:

The **matrix resolution** is the number of columns and rows containing photosensitive elements in the image sensor system.

Observation field (Point of View - **POV**) - area observed by the camera (dimension eg mm x mm)

Required matrix resolution.

Matrix resolution = (FOV / Object resolution) × 2

= ((FOV / dimension of the smallest element) × 2

ATTENTION:
1. the field of observation and resolution of the object **must have the same dimension**,
2. for calculations, **choose the larger dimension length x width** for the field of observation,
3. cameras are produced with **some typical resolutions**.

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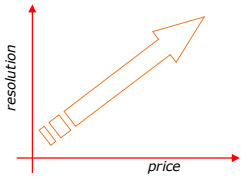
Vision system setup:

Typical matrix resolutions:

Number of CCD Pixels	FOV	Resolution
640 × 480	60 mm	0.185 mm
768 × 572	60 mm	0.156 mm
1280 × 1072	60 mm	0.093 mm
2048 × 2048	60 mm	0.058 mm
4000 × 2624	60 mm	0.030 mm



If there is no matrix with the required resolution, use the nearest higher resolution or use several matrices (cameras).

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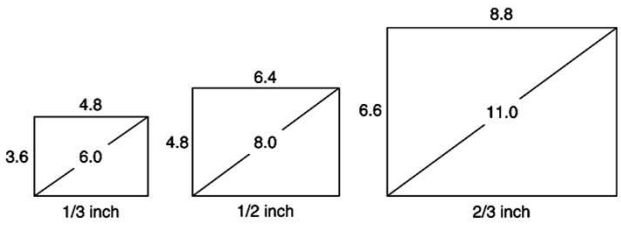
Vision system setup:

Matrix sizes: defined by the diagonal.



Units: mm

Typically, the resolution of the matrix and its size are related and fixed.

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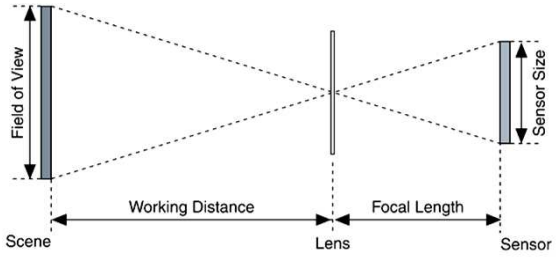
Vision system setup:

Application of lenses:



Focal Length = (Sensor Size × Working Distance) / FOV

Attention:
1. lenses → focal length standards: 6 mm, 8 mm, 12.5 mm, 25 mm, 50 mm.
2. select the lens with the closest focal length to the one required.
3. for the selected matrix and lens, the distance to the object should be corrected,
4. lenses with a focal length of less than 12mm usually **give a large image distortion**.

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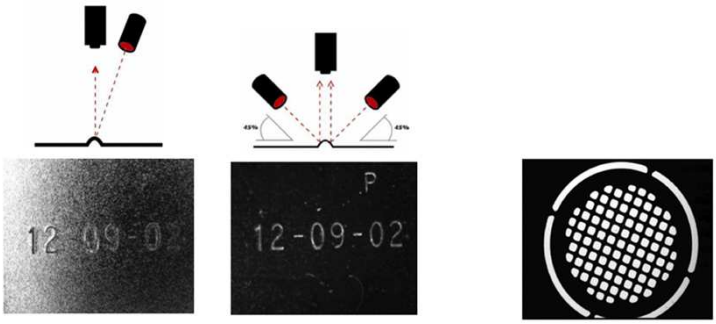
Vision system setup:

Contrast: determines the difference in the intensity of the color of the object and the background to be examined. The high contrast allows sure separation of the object and the background.

Lighting plays an important role here.



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Vision system setup:

Depth of object (DOF) Depth of Field: the difference in height in the observed object affects the possibility of maintaining the sharpness of the image.

The lenses play a central role here. You can use a lens with a **variable focal length** and use the so-called **autofocus**.

You can also improve the sharpness **by reducing the iris of the lens and illuminating the subject more strongly**.

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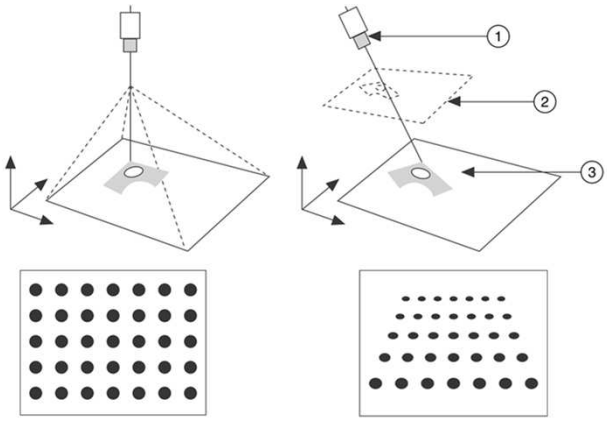
Vision system setup:

Perspective: the error occurs when the camera is not set perpendicular to the analyzed object.



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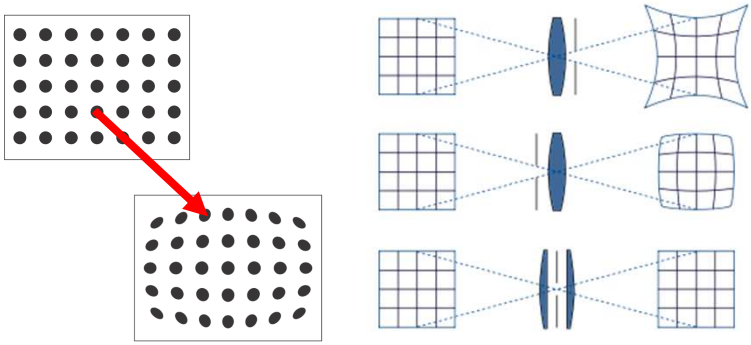
Vision system setup:

Distortion: optical **defect of the optical system** based on a different magnification of the image depending on its **distance from the optical axis** of the instrument. It usually causes a non-linear image distortion.



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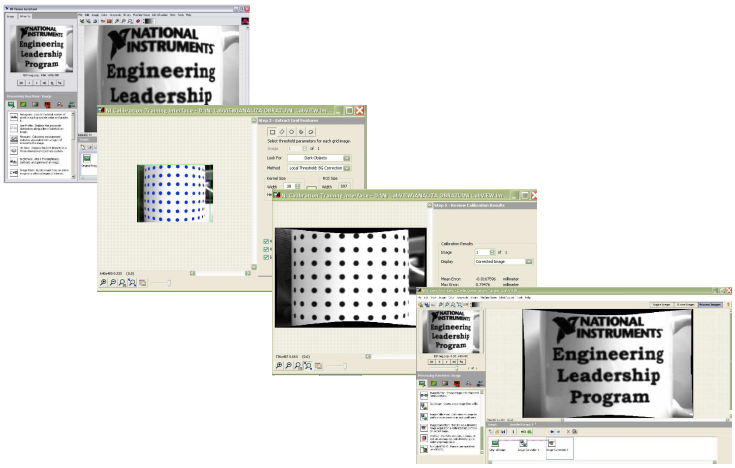
Corrections and teaching:



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Corrections and teaching: