

How to Select a Camera for your Industrial Application

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There are several selection criteria that vision developers or users should keep in mind when selecting a camera for their vision system.

FIELD OF VIEW (FOV) AND RESOLUTION REQUIREMENTS

The field of view (FOV) and the detail size that need to be resolved in the image will determine the sensor size and amount of pixels required. A simple calculation of the number of pixels necessary to resolve a defect of a known size will provide minimum number of pixels per mm which in turn multiplied by the longest dimension of the FOV will provide the required resolution. The sensor size depends on the FOV and the optics.

IMAGE QUALITY

Against common perception, image quality goes far beyond resolution. Vision users have to consider advantages of CCD vs. CMOS based cameras and, especially in the case of high-end quantitative applications, specifications such as readout noise, dark noise, SNR and light sensitivity should play an important role in the selection process.

FRAME RATE

Frame rate in conjunction with resolution and the number of bytes per pixel determine the amount of data that needs to be transferred and processed. For example, a camera with a 1280 x 1024 (SXGA) resolution at 30 frames per second (fps) and 8bits (or 1 Byte) per pixel will require a data bandwidth of approximately 50MBytes/sec. This is below the PCI bus limit (~100MB/sec) and is within the capabilities of 1394.b or Gigabit Ethernet interfaces. Anything beyond 100MB/sec will require a frame grabber-based system with Camera Link® interface and PC with PCI Express® bus.

INTERFACE TYPE

Beyond the frame rate and bandwidth requirements, data transfer reliability is an important factor in choosing a suitable camera interface type. Vision users that consid-

er deterministic data transfer as their first priority prefer to use systems with analog or digital cameras connected to capture boards with on-board memory buffers that guarantee lossless image transfer. Among the non-frame grabber interfaces, IEEE-1394 through the IIDC standard offers excellent provisions for reliable isochronous image transfer with minimal CPU usage.

Another important factor that comes into play when choosing the interface is cost. Analog cameras on average cost less than digital cameras and are built utilizing a single, well-established interface. Typically, the more cameras that are required to perform a single vision task, a frame grabber-based solution becomes most cost effective. On the other hand, with systems using digital cameras, the advantages are features and performance: high resolution options, high frame rate capability and image quality. The cost of cabling cost is also becoming an advantage with non-frame grabber digital interfaces. Overall, the cost gap between these two technologies is rapidly closing.

SUPPORT AND SOFTWARE DRIVERS

Vision users should always look for a vendor that provides reliable drivers, a user friendly software developer kit (SDK) and good technical support. The software component of a vision system is increasingly becoming the most important factor in determining the amount of resources and time that will need to be invested. Simplifying this effort is a clear trend in today's machine vision industry.

FORM FACTOR AND RELIABILITY

Form factor is an obvious consideration. Regarding product reliability, with so many choices available today, vision users should seriously consider a manufacturer with solid reputation. After all, cameras are the "eyes" of their system and the last thing they need is to go "blind" in the middle of a critical task!

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