Advanced software that tightly integrates the PC to various types of cameras has led engineers and scientists around the world to install computer-based vision systems. They reside in a variety of industries, such as semiconductor, telecommunications, electronic, automotive, medical, pharmaceutical, consumer goods, and packaging. They automatically gauge, guide, identify, and inspect products as they zip through high-speed manufacturing and testing processes.

Flexible Vision Systems Work With Variety of Cameras

Images of the manufactured products are obtained by cameras, which form the basis of every vision system. The camera contains sophisticated sensors that convert visual scenes into electrical video signals that a computer can then analyze. Vision system developers can choose from two types of cameras: analog and digital.

Analog video predominates. Video professionals have widely adopted the gray scale and color analog video formats; therefore, any basic computer-based vision system should easily accept both monochrome and color analog signals. However, different types of analog cameras transmit color and brightness information in different ways, and a flexible computer-based system will accept several different types of these color analog signals.

Digital cameras transmit a cleaner image than analog because a digital stream of data is less susceptible to noise and distortion. An analog camera sends its signal to a plug-in computer board that transforms the signal from the camera into digital code. The computer's central processing unit can then process the code for analysis and presentation. With digital cameras, the analog signal becomes digital inside the camera before it reaches the computer.

Digital cameras also transmit their signal at higher speeds than their analog counterparts. Some digital cameras can output data at rates greater than 100 megabytes per second. To handle this speed, it is necessary to have a computer plug-in board specifically suited for digital cameras. Some of these computer boards can accept information at rates as high as 200Mbytes/s.

Computer Software Performs Sophisticated Analysis

While the camera provides the necessary inputs for the computer, the software efficiently transforms them into vivid, useful images. Today, graphical programming incorporated with easy-to-use vision software tools make sophisticated analyses, such as pattern and color matching, possible in a PC point-and-click environment. Graphical programming software eliminates the need to write and debug countless lines of text-based computer code, saving people time and opening computer-based vision systems to nonprogrammers.

National Instruments offers a point-and-click graphical programming environment with National Instruments LabVIEW™ and IMAQ™ Vision tools. With LabVIEW, users build virtual instruments instead of complicated text-based programs by using icons and block diagrams familiar to engineers and scientists. LabVIEW analyzes and presents data, and IMAQ Vision provides LabVIEW with specific virtual instruments (VIs) for acquiring and analyzing images from cameras. These VIs are analogous to functions in text-based programming languages. In LabVIEW they are the building blocks that provide special measurement functions.

IMAQ Vision pattern-matching virtual instruments quickly and accurately locate objects regardless of size, orientation, focus, or lighting. To match patterns, National Instruments uses a revolutionary, patent-pending image algorithm that runs more than 100 times faster than traditional pattern matching algorithms. In addition to pattern matching, IMAQ Vision users can

measure, compare, and match colors – important to automotive, pharmaceutical, printing, and other industries that must accurately judge color quality.

For the beginner, National Instruments also offers Vision Builder, an easy-to-use program that allows users to build and test their own vision programs. Once the beginner develops a program, Vision Builder automatically produces a code recipe that can guide LabVIEW, Visual Basic, and C developers.

Tireless electronic eyes around the world inspect and guide an ever-widening range of applications ranging from saving lives by ensuring the correct drug capsule is inserted in packaging on the manufacturing line, to inspecting antilock brake sensors before installation on cars. Whatever the application, PC-based vision systems improve the quality of products around the world.

Glossary of Vision Terminology

Analog Camera	A camera that transforms light information into pixels and then outputs an analog video signal.
Blob	Binary large object. A connected region or grouping of pixels in an image in which all pixels have the same intensity level.
Blob Analysis	A series of processing operations and analysis functions that produce some information about the blobs in an image.
Color Matching	An algorithm for matching a color template model with a color sample.
Digital Camera	A camera that transforms light information into pixels and then outputs a digital video signal.
Infrared Camera	A camera that measures the emission of thermal or infrared, energy. Hotter objects emit more infrared energy, and the cameras measure these differences and display them in varying colors.
Pattern Matching	An algorithm for locating a feature within a gray scale image.
Thermal Imaging	Acquiring images of varying levels of heat emission that the naked eye cannot see by using an infrared camera.