PC-Video Image Management and Measurement System

(Lite Edition)

Revision 2.0
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# © Visual Inspection System

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ViS v2.20 System Requirements & Settings

System Requirement
- Microsoft Windows 95/98/ME/2k/XP
- Pentium 200MHz or higher (using Video Capture Card)
- Pentium III 700MHz or higher (using Digital Camera)
- 128 MB RAM or more
- External Display Card (No Built-In Display/VGA Card)
- 8MB Video RAM or more (supports DirectX)
- 1.2 GB Hard Disk or more
- SVGA or XGA Monitor Display (Res.:1024x768 or 1280x1024)
- PAL/NTSC Video Camera or Digital Camera (Direct Show, WDM)
- Color Printer (Optional)

Windows Settings

- Install DirectX 6 or above (CD bundled DirectX 8.1)
- Set your Windows video display to 16 or 24 Color, Resolution 1024x768 Pixels or higher for larger view.
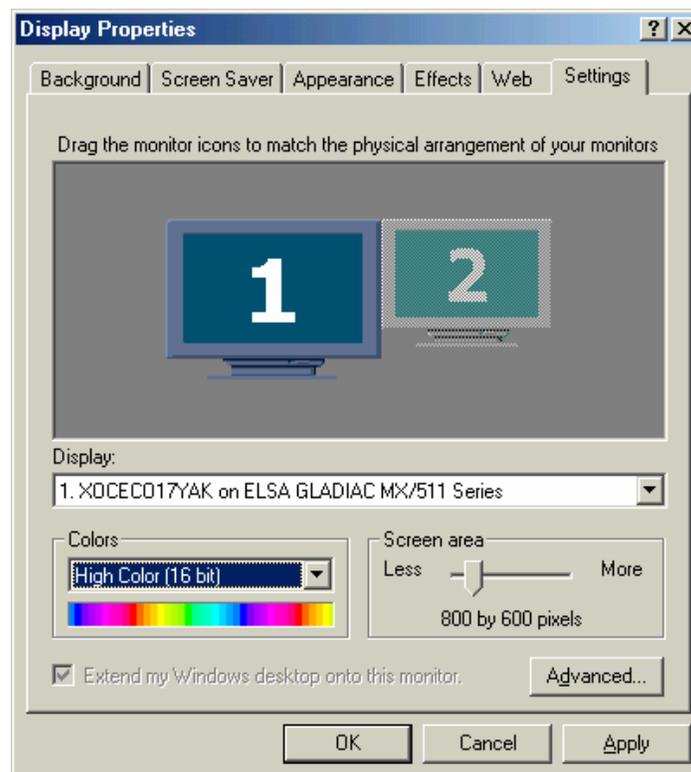
ViS Video Capture Card Installation

Install the hardware:

Step 1: Power off your PC. Remove the screw and cover plate of and unused expansion slot.

Step 2: Press the ViS Video-Capture card firmly into the slot. Now you are prepared to connect the video source to your capture card.

Step 3: Connect your Video in Cable to the card as shown in Figure below,
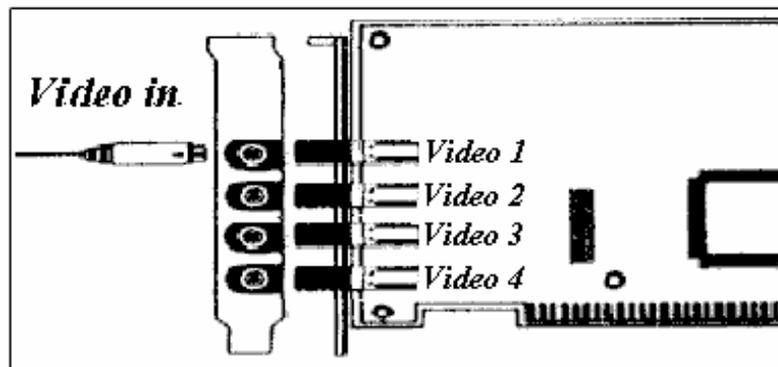

Install Hardware Driver:

Step 1: Turn on your PC and starts Windows 95/98/ME.

Step 2: Insert the CD labeled "ViS v2.00 Video Setup & Driver". A dialog box with a message of "New Hardware Found" is shown on your screen.

Step 3: Select the drive from the box "Driver from disk provided by hardware manufacturer" and click "OK" button.

Step 4: In the "Insert the disk" window, click "OK" and select "VIS100.INF" in the text box and click the "OK" button. Then, select "ViS Fast Video Capture Device" to continue.

Step 5: If the system prompt another message for inserting disk like shown in the below diagram, just click "OK" to continue,
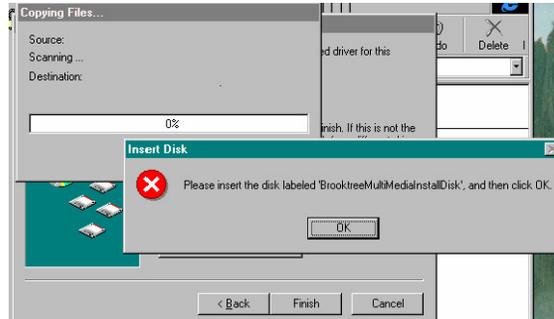
Then, if another message dialog box appears like diagram below, in it's input field, type in your CD-ROM drive, i.e. "E:" and click "OK" to finish the process.
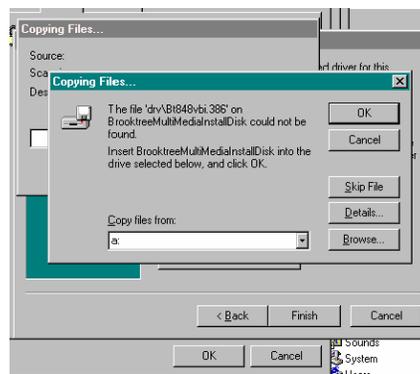
USB 2.0 Digital Imaging Camera Installation

Installing the Digital Camera (DC)
Installing the DC is easy. You'll need to do the following:
- Check the host computer configuration
- Connect the camera to the computer
- Install the driver software from the support CD
- Install the imaging software from the support CD (optional)

Checking the Host Computer
The computer you connect the camera to should meet the following minimum requirements:
- 1GHz Pentium III processor or above, Pentium IV 1.5GHz or greater for full performance
- 128MB system memory
- Hi-Speed USB 2.0 port
- Display card capable of true-color mode
- Microsoft Windows 98SE, ME, 2000 or XP

Since video processing is hardware intensive, a faster computer with a fast hard disk drive and extra memory will yield better results.

Some computers, particularly notebook computers, may only have USB 1.1 ports. You can use an DC camera with a USB 1.1 port, but the data transfer rate will be considerably slower than a Hi-Speed USB 2.0 port. You can also upgrade your system by adding USB 2.0 ports via an expansion card. If you install such a card, confirm that it is properly installed or the DC camera may not work properly.

Connecting the Digital Camera
You can connect USB devices to a computer while the computer is turned on. This "hot plug" capability is a convenient feature of USB products. To connect the camera to a computer does as follows:
- Plug the connector on the camera's attached USB cable into an open USB port on your computer.

When you connect the camera, it's power LED should light and the computer's Operating System should recognize it. When you connect the camera for the first time you will need to install the supplied driver software that comes on the Support CD. For more on this, see the next section.

Installing the Driver Software
The DC comes with driver software on the Support CD. The driver software enables the CD camera to work with the computer. You must install it before you can use the camera.

As mentioned in the previous section, when you first connect the camera to a host computer, the Microsoft Windows operating system will automatically recognize that the camera is connected. You then need to install the camera's supplied driver software as follows. This explanation uses Windows XP as an example.

1. When you plug the camera into a USB port on the computer, the operating system will automatically detect it and display a message to that effect. It will also run the Found New Hardware Wizard. Use the "*Install from a list or specific location (Advanced)*" option.

2. Then, place the DC driver CD in the CD's drive and click "Browse" button to browse to the CD's driver location or enter the driver's path name.
The wizard will automatically find the driver files on the driver CD and install them. Follow the instructions on the wizard screens. If a warning about the driver appears, press the Continue Anyway button.

3. When the installation if completed, click on the "Finish" button to finish the camera driver installation.

After the driver is installed, you can check the installation status by executing the "Settings"->"Control Panel"->"System" dialog. The System Properties window will appear. Click on the Hardware tab and then the "Device Manager" button.
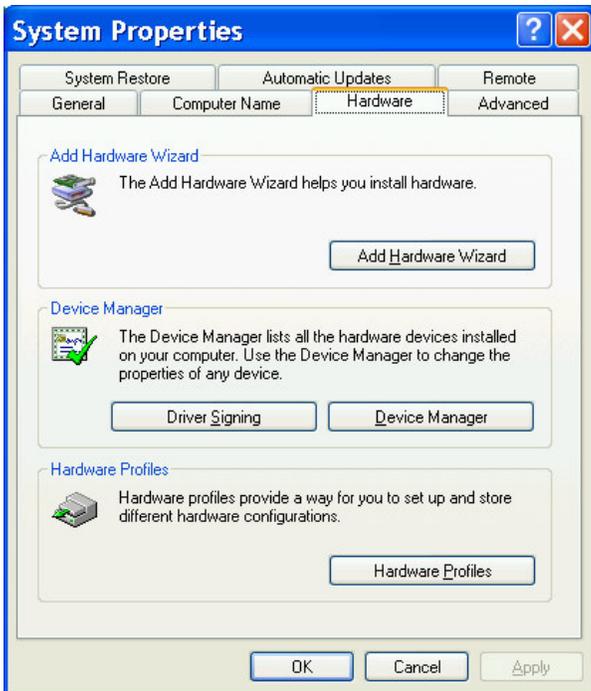
In the Device Manage window that appears, click on the "Imaging Device" item. You should see a listing for "VDIT USB 2.0 Camera". Double click on it to bring up the properties windows for the device.
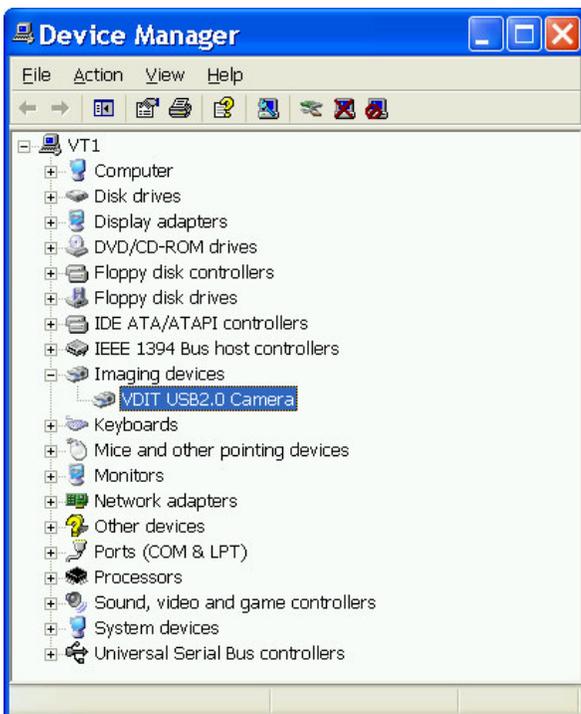
In the properties window, there should be a message indicating the device is working properly. If the message says the device isn't working properly, click on the Driver tab and click the Reinstall Driver button. Follow the process through to the end and then reconfirm that the installation was successful and the device is working properly. If it still is not working properly, consult your vendor.

USB 2.0 Digital Camera Troubleshooting
This section covers a few points you can check in the event your have a problem using your camera.

- Make sure the camera is connected to a Hi-Speed USB 2.0 port. USB 2.0 and USB 1.1 ports look the same. If you plug the DC camera into a slower Full-Speed USB 1.1 port, Windows XP will display a warning message. If you click on it, you'll see the troubleshooting window shown below.

- Make sure the correct driver software is properly installed. See the section on driver installation. You can check the driver information in the "Device Properties window".

- Make sure the USB cables are correctly connected. The connector should be fully inserted in the port on the computer.

- Check the camera Video Capture Filter settings in software. Make sure the settings are for the specifications the DC supports, for instance, RGB 24 mode.

ViS Installation

Insert the ViS CD into your CD-ROM drive, the setup wizard appears automatically.

Click this button if you are installing ViS on the **Windows XP** or **Windows 2000** operating system to install the dongle drivers. Or else, just skip this button and go to the next.

Then click the "Start ViS Installation" to start the ViS main program installation,

Click Next

User Information

Type your name below. You must also type the name of the company you work for.

Name: [   ]

Company: [   ]

< Back   Next >   Cancel
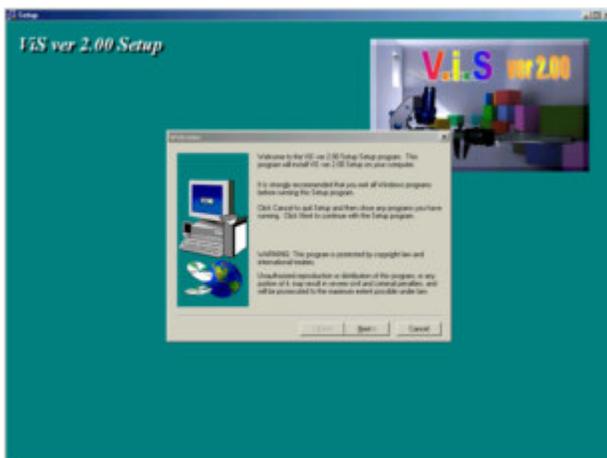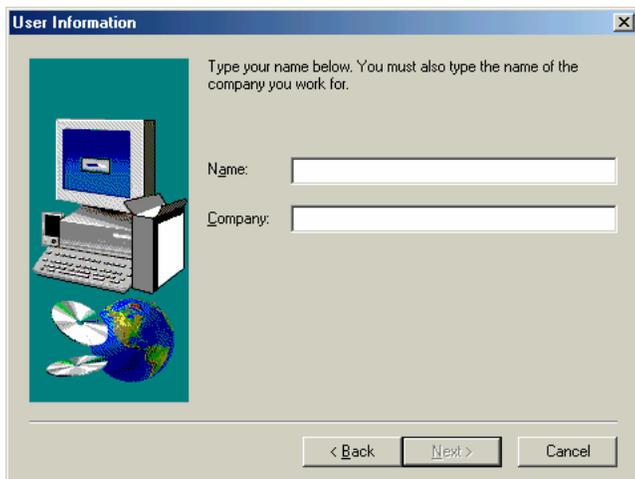
Enter your name and company name and Click Next

Choose Destination Location

Setup will install ViS ver 2.00 Setup in the following directory.

To install to this directory, click Next.

To install to a different directory, click Browse and select another directory.

You can choose not to install ViS ver 2.00 Setup by clicking Cancel to exit Setup.

Destination Directory

C:\vis2   Browse...

< Back   Next >   Cancel
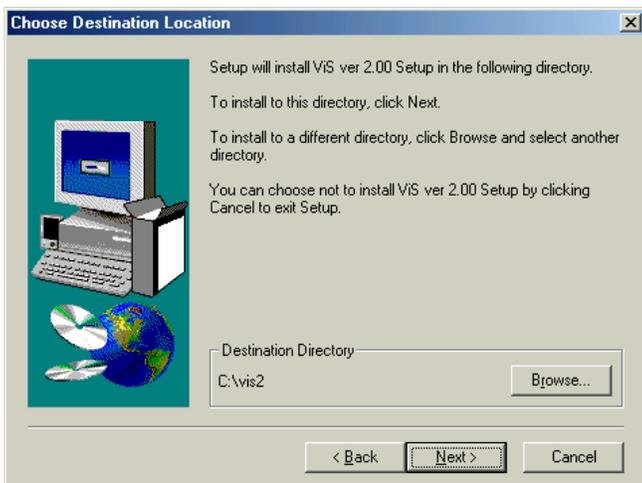
Select the destination directory name for ViS to install. Recommended to use the default name "C:\vis2"

Then, click "yes" in the next screen until the program is installed…

Setup Complete

Setup has finished copying files to your computer.
Setup will now launch the program. Select your option below.

☐ Yes, Launch the program file

Click Finish to complete Setup.

< Back   Finish

The installation is completed and you can start using ViS 2.00. Do ensure that the digital camera or video capture card is installed also.

Basic Software Operation
1.) Quick Start
When ViS is just started, the program shall be displayed like shown below,

Open or Create new image file

Image Album

Video/Image Acquisition
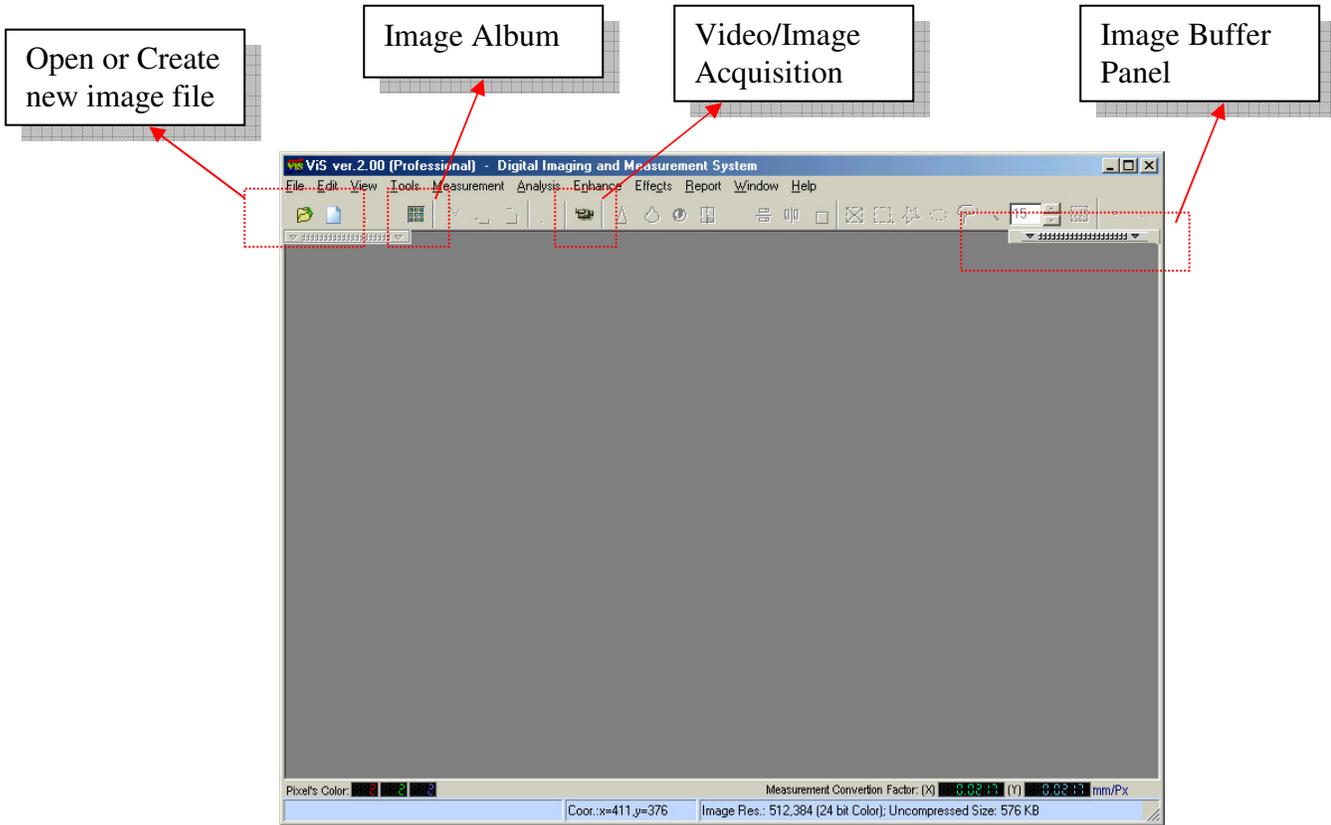
Image Buffer Panel

User may use any of the above options to open image or create new image. All these features can also be found in the Main Menu (Pull-Down Menu). Click on the "Image Buffer" or "Image Album", the below dialog shall be displayed.

Image Buffer
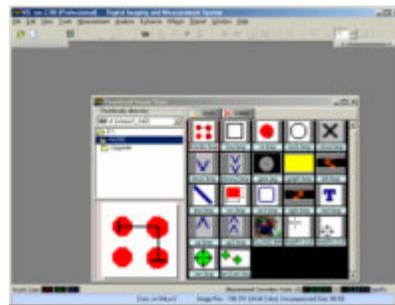
Image Album

Image Buffer is for faster temporary image storing and retrieving. Anyway, images in the image buffer will always retains even the program is closed or restarted until user deletes or clears the image.
Whereas, the Image Album is more for the purpose of image achieving. User can easily transfer the image from Image Buffer into the Image Album by Drag-And-Drop the image to Image Album.

2.) Work with Image Buffer
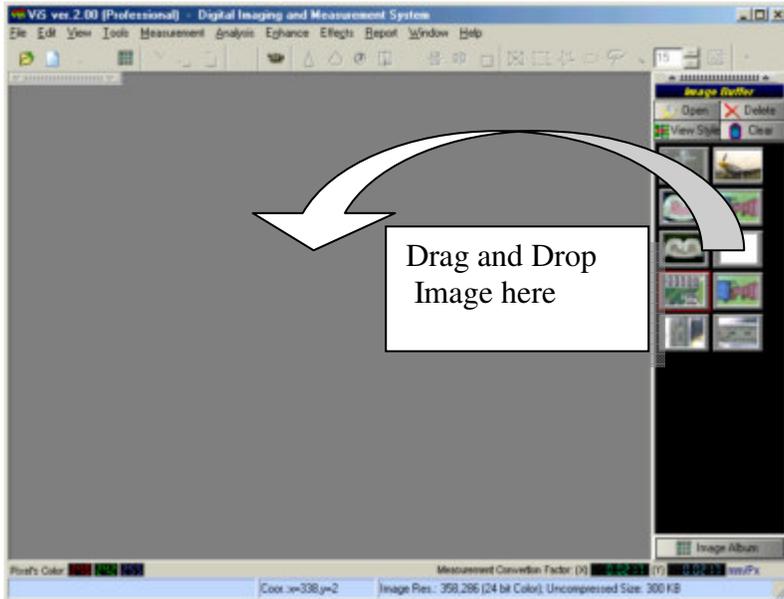
User can drag and drop an image from the Image Buffer to the Main Working Space to open the image. On the other hand, Image in the Working Space can be also drag and drop into the Image Buffer

Drag and Drop Image here

* Note : To do Drag and Drop on the image. ROI tools must be deselected using this button.

Drag and Drop Image here
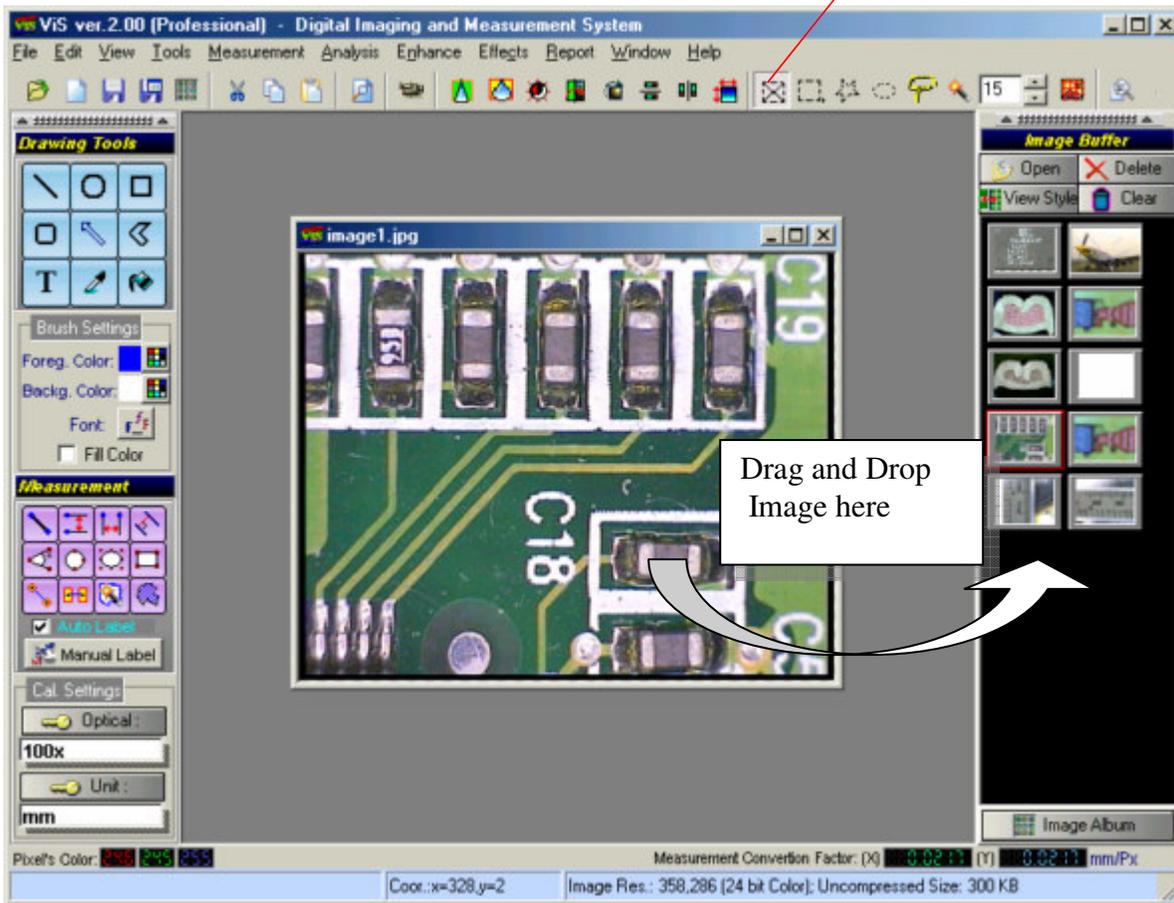
3.) Image/Video Acquisition
To acquire or capture image or video from the camera, click on the "Video Camera" icon,
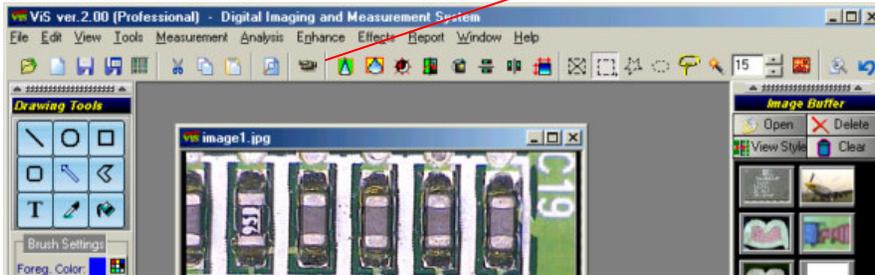
Then, user should enter to the video/image acquisition page like below,

Display Live Video

Capture Image to the Image Buffer

Change Video Format

Change Video Settings

Enter Video Recording Mode

Return to Main Program Area with captured image

Return to Main Program Area
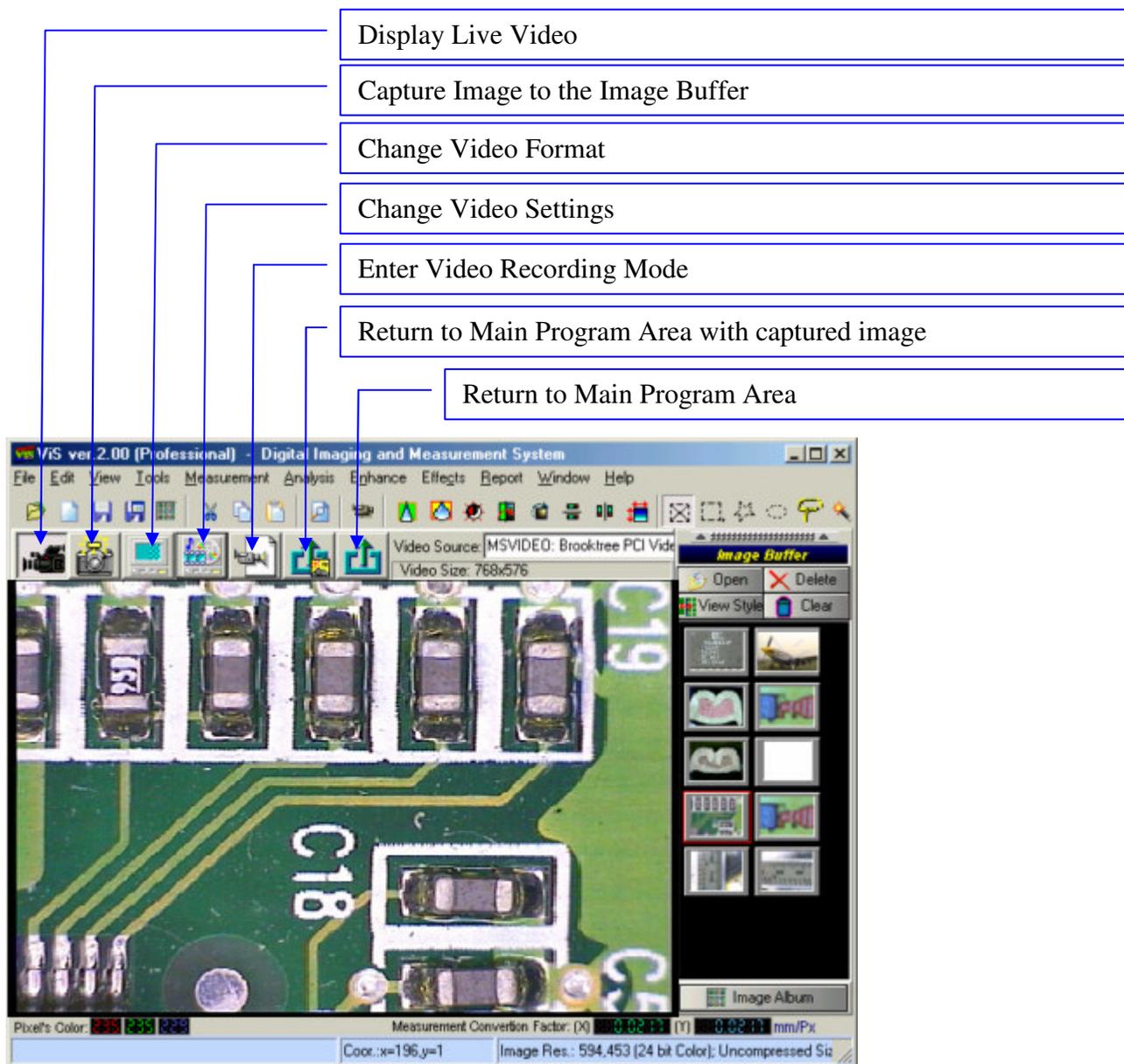
<div style="border: 1px solid">1</div> Before capturing, the "Live Video" button must be clicked to enter the Live/Preview Video Mode.

<div style="border: 1px solid">2</div> To capture multiple images during the acquisition session, user should use the "Capture to Image Buffer" button to grab images.

<div style="border: 1px solid">3</div> Else if just to quickly capture an single image, click the "Return to Main Menu with Image".
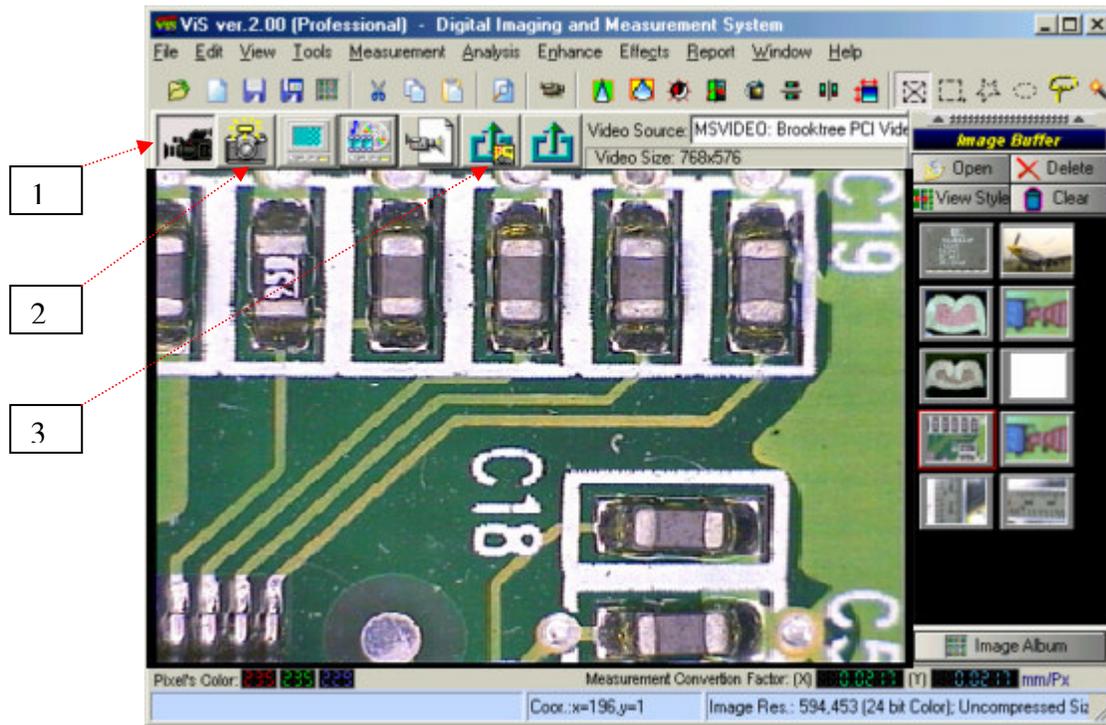
4.) Video Recording

To enter to the Video Recording Mode, click the "Video Recording" button to show the video recording panel.

Video Recording Panel

Then, enter the file name of the video movie to be recorded and choose the video Frame Rate (Higher Frame Rate will increase the Video File Size). Next, choose the CodeC or Video Codec which is the video recording compression method to be used during the recording session (it shall display all available codec drivers that installed in this computer). Lastly, click on the "Record" button to start and stop movie recording.

Image Annotation (Drawing)

With the annotation tool, user is able to stamp text, draw arrows, lines, pick color etc. For more information of the tool icons, just move the mouse cursor to the icon and read the pop-up tips. The user can also select font type, background color, size, etc.
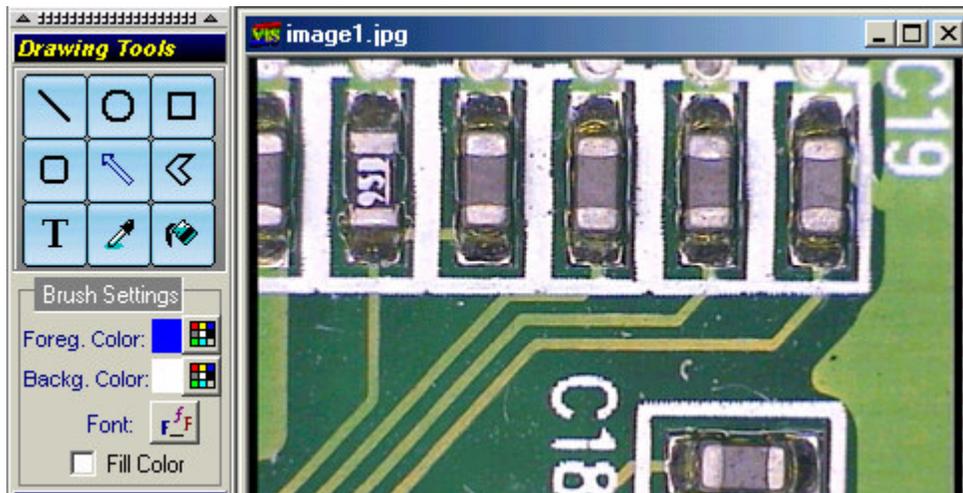
To stamp text on your image:
1. Click the "Text" icon.
2. Click the cursor on to the image.
3. To edit the text, just click on the text box.
4. To stamp the text permanently, double click the text box or click on the image.

To draw arrows:
1. Click the 'arrow' button and position cursor to the desired location. Then click and hold down the mouse button, and move it to another location which is the arrowhead.
2. User may change the arrow style by changing the "Brush Settings".

To Draw Shapes
1. Click on the desired shape that you require.
2. Draw on the image.

Image Processing (**Enhance and Effects**)

User can perform image enhancement or effects on the whole image or selected image region (ROI – Region Of Interest) using the following ROI tools, inclusive of Rectangle, Polygon (Multi Points), Ellipse, Lasso and Magic Wand ROI Tools.

ROI (Region of Interest) Tools

Click the "Deselect" button if user doesn't want the ROI selected. Only in this mode, user is allowed to Drag and Drop image to the image buffer.

Image Processing Toolbar
Now, user can select the image processing tools in the Main Menu (Pull-Down Menu) or the toolbar as shown below,
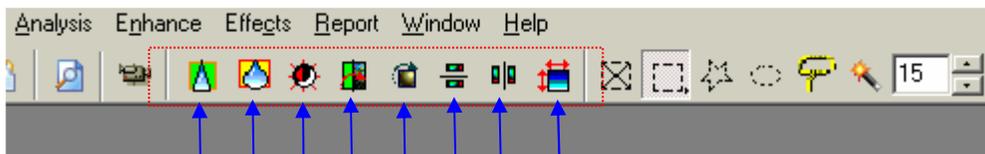
Resize Image

Mirror Image

Flip Image

Rotate Image

Emboss Image

Change Image Brightness and Contrast

Smoothen Image

Sharpen Image

Image Enhancement
For more image enhancement tools, click on the Main Menu -> Enhance and select the desired tools.
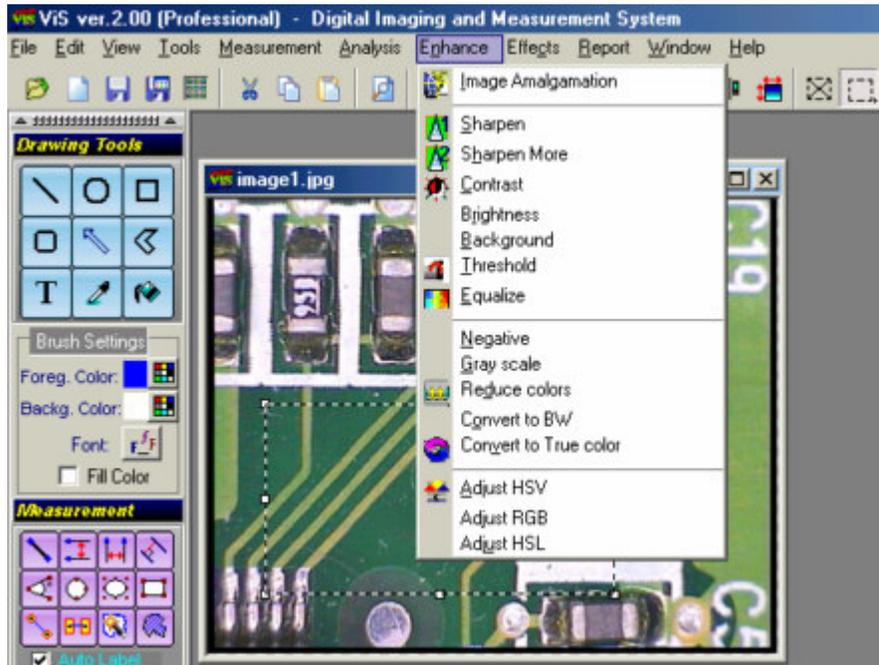
For certain tools, e.g. Contrast, Brightness, Threshold etc, a Preview dialog box like below will be displaying for user to preview the image while adjust the appropriate value,
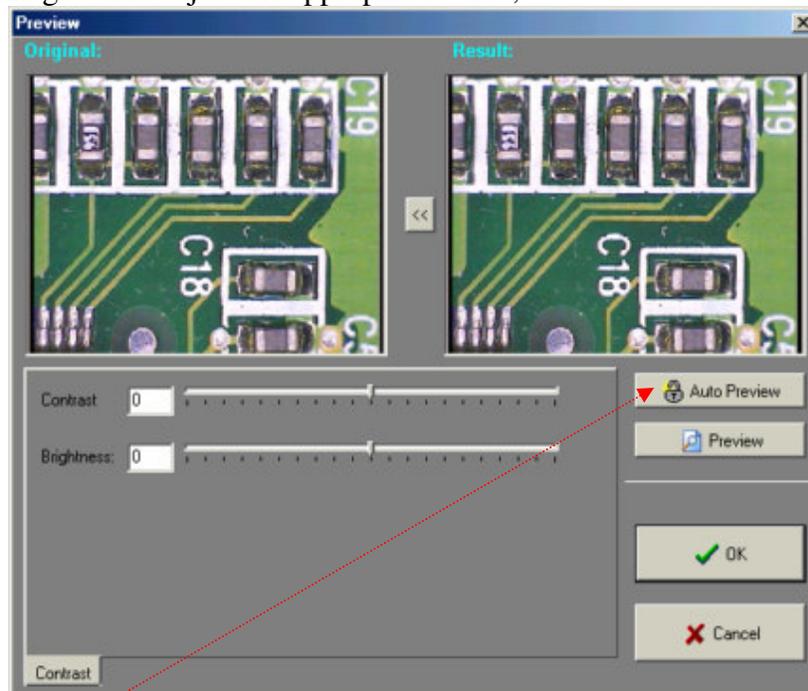
Click the "Auto preview" button to enable the auto preview mode that shall refresh the result image (Right Image) automatically while user is adjusting the value.

1.5   Password Protection Settings

ViS also provides basic security functions to protect ViS against unwanted access by the user without permission, and prevents unnecessary intervention to the calibration data. Anyway, these security features can be enabled or disabled anytime.
Basically, it has two levels of security password,

1.) **Admin Password** : Password to access and modify "Password Settings" menu and protect calibration data from any unnecessary intervention.

2.) **User Password** : Password for the normal users to run ViS software. When this feature us turned on, every execution of ViS is password needed!

To modify the "Password Settings", click the pull-down menu "File" and "Password Setting". For the first time, this setting is not protected as the Admin password is still blank. After Admin password is entered, the "Admin password" is needed to access this feature. Then, a dialog box like below is shown,
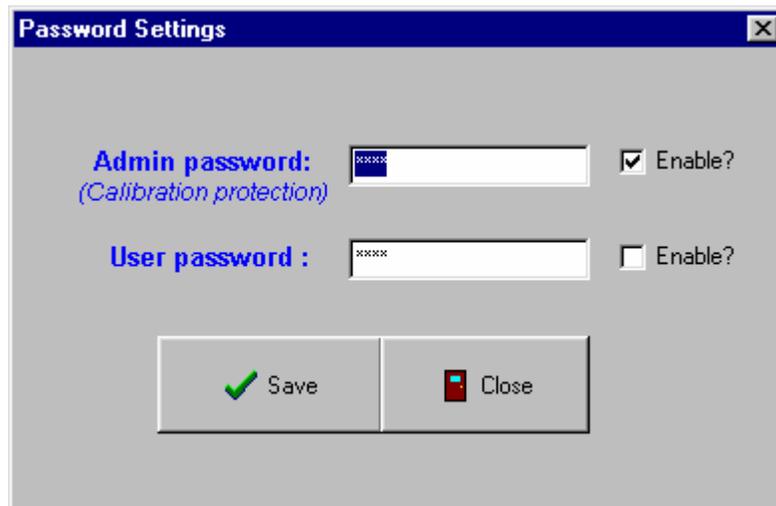
To turn on the protection for calibration, enter the Admin password and check the first "Enabled?" checkbox to enable it! And do the same to the "User Password" setting!

A

Accuracy - The extent to which a machine vision system can correctly measure or obtain a true value of a feature. The closeness of the average value of the measurements to the actual dimension.

Algorithm - A set of well-defined rules or procedures for solving a problem or providing an output from a specific set of inputs.

Area - Portion or area of the image to be analyzed. Area analysis measures the number of pixels which fall in a specified range of gray levels for the feature of interest.

B

Background - The part of a scene behind the object to be imaged.

Bandpass Filter - An absorbing filter which allows a known range of wavelengths to pass, blocking those of lower or higher frequency.

Binary - An image with pixel values either one or zero.

Binary image - A black and white image represented as a single bit containing either zeros and ones, in which objects appear as silhouettes. The result of backlighting or thresholding.

Bit - An acronym for a BInary digiT. It is the smallest unit of information which can be represented. A bit may be in one of two states, on or off, represented by a zero or a one.

Bit Map - A representation of graphics or characters by individual pixels arranged in rows and columns. Black and white require one bit, while fancy high definition color up to 32.

Boundary - The line formed by the joining of two image regions, each having a different light intensity. The edge of a region or object.

Brightness - The total amount of light or incident illumination on a scene or object per unit area. Also called intensity.

Byte - Eight bits of digital information. A byte has values from 0 to 255, and is the unit most common to represent the gray scale value of one pixel.

C

Calibration - The act of relating X and Y pixel spacing to a known or predetermined pixels per unit length (ie inch, mm) factor. Often involves adjusting the imager position in setup.

CCD - Charge Coupled Device. A photo-sensitive image sensor implemented with large scale integration technology.

CCD - Frame Transfer CCD. The entire image is transferred from the sensing area to a storage area on Chip. Data (charge) is read out from the storage area in a full frame mode. This workhorse of the industry is also capable of non-RS-170 operation.

CCD - Interline Transfer CCD. Data (charge) is transferred simultaneously out by odd and even lines or fields directly from the image sensors to their corresponding sensor registers. The output from the camera is always one field (frame) behind the image being captured.

Centroid - The center of mass of an object having a constant density, or of an object having varying density, weighted by the gray scale value.

Closing - A dilation followed by an erosion. A morphological operator useful to close holes and boundaries.

Color - A visual object attribute which may be described by a "coordinate system" such as hue, saturation and intensity (HSI).

Composite Video - A television signal which is produced by combining both a video or picture signal with horizontal and vertical synch and blanking signals.

Contrast - The difference of light intensity between two adjacent regions in the image of an object. Often expressed as the difference between the lightest and darkest portion of an image. Contrast between a flaw or feature and its background is the goal of illumination.

Contrast Enhancement - Stretching of the gray level values between dark and light portions of an image to improve both visibility and feature detection.

Convolution - Superimposing a m x n operator (usually a 3x3 or 5x5 mask) over an area of the image, multiplying the points together, summing the results to replace the original pixel with the new value. This operation is often performed on the entire image to enhance edges, features, remove noise and other filtering operations.

CPU - An acronym for Central Processing Unit. A VLSI chip such as 80486 or pentium.

D

Depth-of-field - The range of an imaging system in which objects are in focus.

Depth Perception (3D) - Measurement of the third dimension of an object or scene.

Digital Camera - The newest generation of video cameras transform visual information into pixels, then translate each pixel's level of light into a number in the camera.

Digital-to-Analog Converter - A VLSI circuit used to convert digital computer processed images to analog for display on a monitor. DAC is the acronym.

Digital Image - A video image converted into pixels. The numeric value of each pixel's value can be stored in a computer memory for subsequent processing and analysis.

Digitization - Sampling and conversion of an incoming video or other analog signal into a digital value for subsequent storage and processing.

Dilation - A morphological operation which moves a probe or structuring element of a particular shape over the image, pixel by pixel. When an object boundary is contacted by the probe, a pixel is preserved in the output image. The effect is to "grow" the objects.

E

Edge - A change in pixel values exceeding some threshold amount. Edges represent borders between regions on an object or in a scene.

Edge Detection - The ability to determine the true edge of an object.

Edge Operator - Templates for finding edges in images.

Electrical Noise - Interference from various electrical devices which is present in the air as electromagnetic radiation or rides on the power lines and can introduce error into low voltage computations such as A/D conversion.

Erosion - The converse of the morphology dilation operator. A morphological operation which moves a probe or structuring element of a particular shape over the image, pixel by pixel. When the probe fits inside an object boundary, a pixel is preserved in the output image. The effect is to "shrink or erode" objects as they appear in the output image. Any shape smaller than the probe (ie noise) disappears.

F

Field-of-view - The 2D area which can be seen through the optical imaging system. (FOV)

Filtering - The use of an optical filter for picture or color enhancement in front of the camera lens or light source. Also analog or digital image processing (IP) operations to enhance or modify an image. May be linear & non-linear.

Filter - A device or process that selectively transmits frequencies. In optics, the material either reflects or absorbs certain wavelengths of light, while passing others.

Fluorescence - The emission of light or other electromagnetic radiation at longer wavelengths by matter as a result of absorption of a shorter wavelength. The emission lasts only as long as the stimulating irradiation is present.

Focal Length - The distance from a lens' principal point to the corresponding focal point on the object.

Focus - The point at which rays of light converge for any given point on the object in the image. Also called the focal point.

Frame - The total area scanned in an image sensor while the video signal is not blanked. In interlaced scanning, two fields comprise one frame. Frame rate is typically 30 Hz.

Frame Buffer - Image memory in a frame grabber.

Frame Grabber - A device that interfaces with a camera and, on command, samples the video, converts the sample to a digital value and stores that number in a computer's memory.

G

Gamma - The numeric value for the degree of contrast in a television picture. The exponent in the power law relating output to input signal magnitude. Non-linear camera tube.

Gray level - A quantized measurement of image irradiance (brightness), or other pixel property typically in the range between pure white and black.

Grayscale Image - An image consisting of an array of pixels which can have more than two values. Typically, up to 256 levels (8 bits) are used for each pixel.

GUI - An acronym for Graphical User Interface. Pronounced "gooie." A Windows based user interface screen or series of screens allowing the user to point-and-click to select icons rather than typing commands.

H

Hardware - Electronic integrated circuits, boards and systems used by the system.

Height/Range - Object profile is usually measured by changes in range or distances from the sensor. 3D techniques are usually used.

High Pass Filter - Passes detailed high frequency image information, while attenuating low frequency, slow changing data.

Histogram - A graphical representation of the frequency of occurrence of each intensity or range of intensities (gray levels) of pixels in an image. The height represents the number of observations occurring in each interval.

Histogram Analysis - Determination of the presence or absence of a feature or flaw based on the histogram values in a certain gray scale region.

Histogram Equalization - Modification of the histogram to evenly distribute a narrow range of image gray scale values across the entire available range.

HSI Conversion - A mathematical conversion from the color RGB space to hue, saturation and intensity values.

HSI - An acronym for the Hue-Saturation-Intensity color representation. A mathematical conversion from RGB. Often used for machine vision analysis.

Hue - One of the three properties of HSI color perception. A color attribute used to express the amount of red, green, blue or yellow a certain color possesses. White, gray and black do not exhibit any hue.

I

Illumination - Normally a wavelength or range of wavelengths of light or visible used to enhance a scene so the detector, normally a camera, can produce an image.

Image - Projection of an object or scene onto a plane (ie screen or image sensor).

Image Analysis - Evaluation of an image based on its features for decision making.

Image Capture - The process of acquiring an image of a part or scene, from sensor irradiation to acquisition of a digital image.

Image Distortion - A situation in which the image is not exactly true to scale with the object scale.

Image Enhancement - Image processing operations which improve the visibility of image detail and features. Usually performed for humans.

Image Processing - Digital manipulation of an image to aid feature visibility, make measurements or alter image contents.

L

Laplacian Operator - The sum of the second derivatives of the image intensity in both the x and y directions is called the Laplacian. The Laplacian operator is used to find edge elements by locating points where the Laplacian in zero.

Lens - A transparent piece of material, usually glass or plastic, with curved surfaces which either converge or diverge light rays. Often used in groups for light control and focusing.

Lens Types - The lenses most commonly used in machine vision are: 35mm, CCTV, Copying, Cylindrical, Enlarger, Micrographic, Video, and Wide Angle.

Location - The point in X and Y image space where a recognized object is found.

Look-Up Table (LUT) - High speed digital memory used to transform image input values to outputs for thresholding, windowing and other mappings such as pseudo-color. (-)

Low Pass Filter - A digital or optical filter which passes slow changing, low frequency information, while attenuating high frequency, detailed edge information.

M

Machine Vision - The use of devices for optical non-contact sensing to automatically receive and interpret an image of a real scene, in order to obtain information and/or control machines or processes.

Memory - The internal, high-speed, large capacity working storage in a computer where data and images may be both stored and retrieved.

Micron - One millionth of a meter also called a micrometer.

Monochrome - Refers to a black and white image with shades of gray but no color.

Morphology - Image algebra group of mathematical operations based on manipulation and recognition of shapes. Also called mathematical morphology. Operations may be performed on either binary or gray scale images. Parallel processors are useful to implement.

O

Object - The 3D item to be imaged, gauged or inspected.

Object Features - Any characteristic that is descriptive of an image or region, and useful for distinguishing one from another. A feature may be any measurable item such as length, size, number of holes, surface texture amount or center of mass.

Optical Computing - Performing operations usually handled by electronic, serial computers with optical or photonic circuits/elements in parallel at near the speed of light.

Orientation - The angle or degree of difference between the object coordinate system major axis relative to a reference axis as defined in a 3D measurement space.

P

Pattern Recognition - A process which identifies an object based on analysis of its features.

Perceptron - The basic processing element used in neural networks. A simple analog circuit with weighted inputs and a nonlinear decision element such as a hard limiter, threshold logic or sigmoid nonlinearity.

Pixel - An acronym for "picture element." The smallest distinguishable and resolvable area in an image. The discrete location of an individual photo-sensor in a solid state camera.

Pixel Counting - A simple technique for object identification representing the number of pixels contained within its boundaries.

Precision - The degree of spread or deviation between each measurement of the same part or feature. Repeatability.

Prism - An optical device with two or more non-parallel, polished faces from which light is either reflected or refracted. Often used to redirect light as in binoculars.

Processing Speed - A measure of the time used by a vision system to receive, analyze and interpret image information. Often expressed in parts per minute.

Profile - The 3D contour of an object.

R

RAM - An acronym for Random Access Memory for storage and retrieval of data.

Range Measurement - Determination of the distance from a sensor to the object.

Region - Area of an image. Also called a region of interest for IP operations.

Repeatability - The ability of a system to reproduce or duplicate the same measurement. See precision. The total range of variation of a dimension is called the 6-sigma repeatability.

Resolution, Pixel Grayscale - The number of resolvable shades of gray (ie 256).

Resolution, Image - The number of rows and columns of pixels in an image.

Resolution, Spatial - A direct function of pixel spacing. Pixel size relative to the image FOV is key.

Resolution, Feature - The smallest object or feature in an image which may be sensed.

Resolution, Measurement - The smallest movement measurable by a vision system.

RGB - An acronym for the Red-Green-Blue color space. This three primary color system is used for video color representation.

ROI – Region of Interest.

S

Saturation - The degree to which a color is free of white. One of the three properties of color perception along with hue and intensity (HSI).

Scene - The object and a background in it's simplest form. A portion of space imaged by a vision system for investigation or measurement.

Shape - An object characteristic, often referring to its spatial contour.

Shape from Shading - A 3D technique that uses shadows from interaction of the object and the light source to determine shape.

Sharpening - An IP operation which enhances edges. An unsharp mask adds a low pass filtered image to the original, resulting in edge enhancement.

Size - An object characteristic typically measured by x and y dimensions. Size may be expressed in pixels, the system calibrated units of measure or classes or size groups.

Sobel Transform - A 3x3 convolution used for edge enhancement and locating.

Speed - An object characteristic expressed in distance moved per unit time. Velocity. Image blur may be caused by high speeds unless strobes or shutters are used to "stop motion."

T

Thresholding - The process of converting gray scale image into a binary image. If the pixel's value is above the threshold, it is converted to white. If below the threshold, the pixel value is converted to black.

V

VGA - An acronym for Video Graphics Array. The IBM video display standard of 16 colors.

Video - Visual information encoded in a specific bandwidth and frequency spectrum location originally developed for television and radar imaging.

Vision Engine - Analyzes the image and makes decisions, using a very fast processor inside a computer. It performs dedicated evaluation of the pre-processed image data to find features and make measurements. Unlike a personal computer, the vision engine is built for speed, not flexibility.

W

Wavelength - The distance covered by one cycle of a sinusoidally varying wave as it travels at or near the speed of light. It is inversely proportional to frequency.

Window - A selected portion of an image or a narrow range of gray scale values.

Windowing - Performing IP operations only within a predefined window or area in the image.

Z

Zoom Lens - A compound lens which remains in focus as the image size is varied continuously. May be motorized or manually operated.