Automatic Product Measurement and Recording

Presented by

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I³ I-CUBE

"..any sufficiently advanced technology is indistinguishable from magic." Arthur C. Clark

WORLD CLASS,

Requirement: to provide image analysis technology to facilitate automatic measurement.
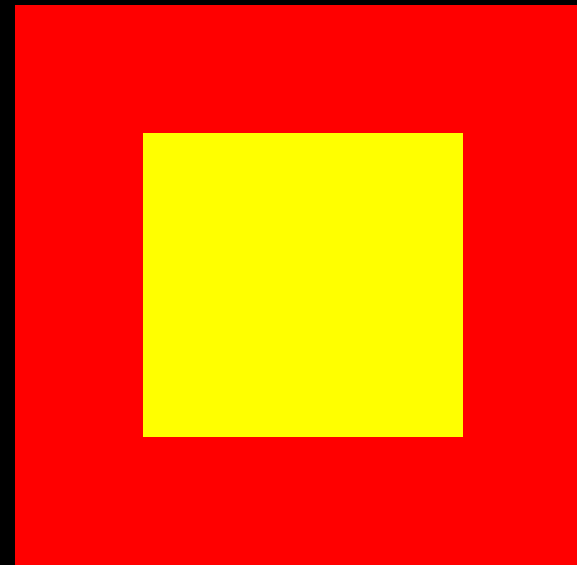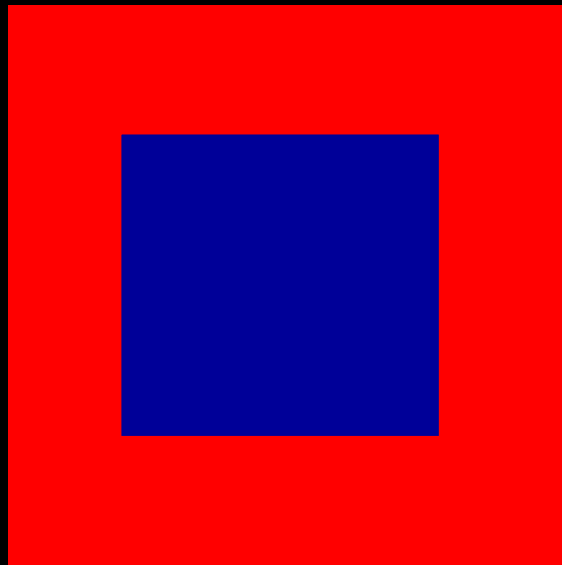
Generation of an ALARM when measured size does not conform to a pre-set threshold.

Why Image Analysis?

- A visual record of all Buses

- Improved Precision

- Accuracy in recording

- Reproducibility of Results

- Higher Throughput than Manual Methods (up to 10 meters a second / PC)
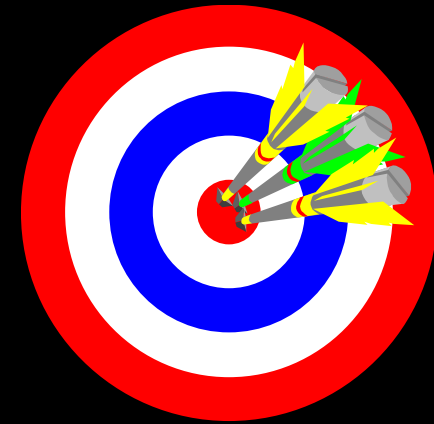
SAME SIZE???

A Word About Our Eyes

- Eyes are very good contrast adjusters, but not good for distinguishing subtle variations in color

- Eyes can discern about 30 continuous levels of gray or color in a field of view (CCTV cameras have 256 levels)
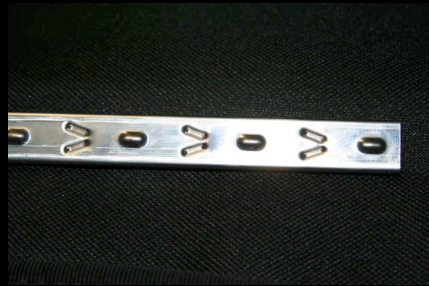
- Eyes cannot accurately reproduce measurements

Why do Image Analysis?

- Improved Precision /Accuracy in Measurements
- Reproducibility of Results
- Higher Throughput than Manual Methods
- Better Definition of Contrasting Areas
- More Measurements / Faster
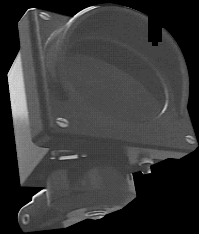- Real Time Link to Databases

BUS:

- Size

- Colour

- Shape

- Texture

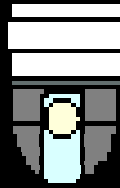# Electronic Imaging Fundamentals

Acquire

Process

Identify

Analyze

Report

Alarm

◆ **Camera (CCTV / Web Cam / IP / etc. CAMERAS**

Ellips RIO

◆ **Frame Grabber**
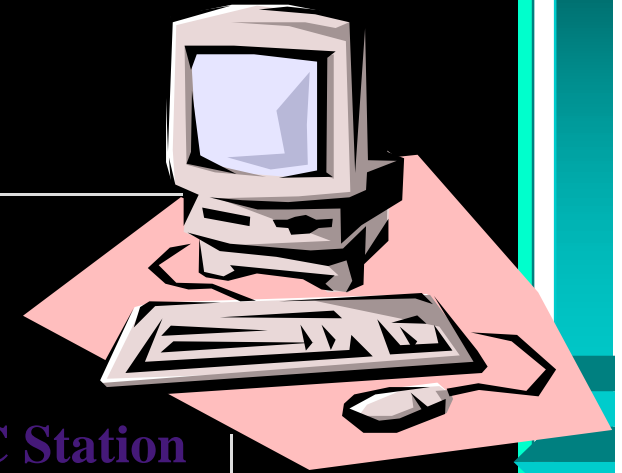
◆ **X-Ray for welding**

◆ **PC Station**

◆ **IA Software**

◆ **IA SYSTEM**
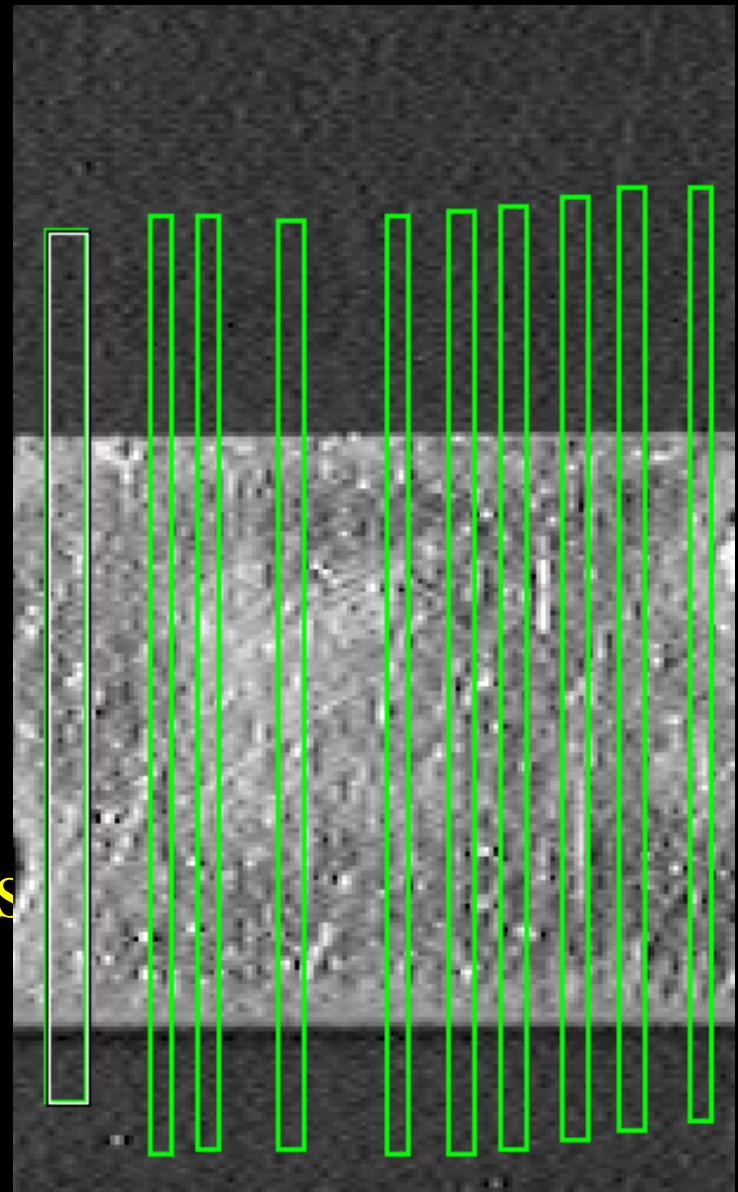
Real Time Width Monitoring

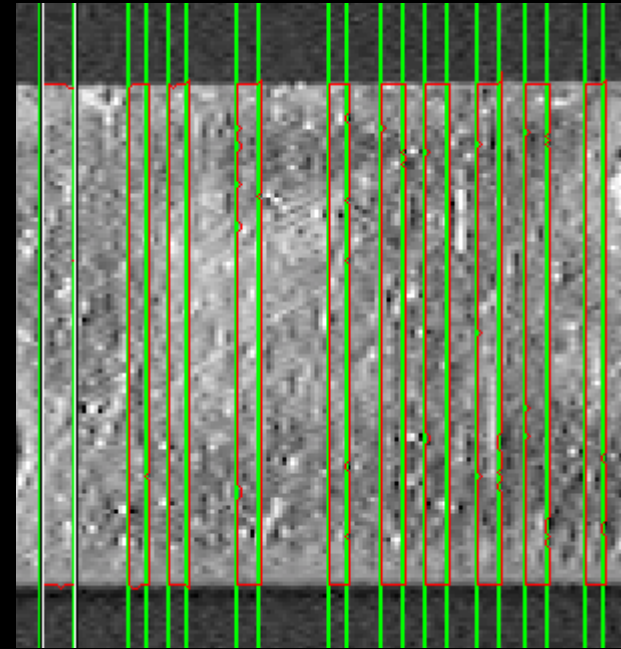◆ Side Camera

◆ Top Camera

Images are recorded and retained

Images are analyzed for specific measurements:

◆ Multiple width measurements per image

Measurement – How the system works

Select Measurements

Measurements:
- Holes
- IOD
- Margination
- Per-Area
- Perim. (convex)
- Perim. (ellipse)
- Perim. (ratio)
- Perimeter
- Perimeter2
- Radius (max)
- Radius (min)
- Radius Ratio
- Roundness
- Size (length)

Filter Ranges:
Area	0.271226	271226.2
Diameter (max)	0	164689.5
Size (length)	0	164689.5

Diameter (max)

Length of longest line joining two points of object's outline and passing through the centroid.

Select All   Select None

Start: 0
End: 164689.50
Edit Range

Measure   Filter Objects   OK

◆ Selected measurement

◆ Diameter measured in RED

Width or thickness Measurements – How the system works
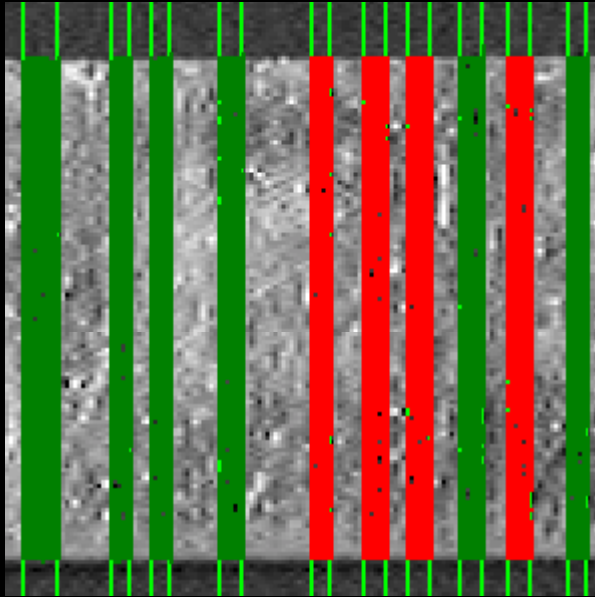
◆ Zoomed in to illustrate accuracy
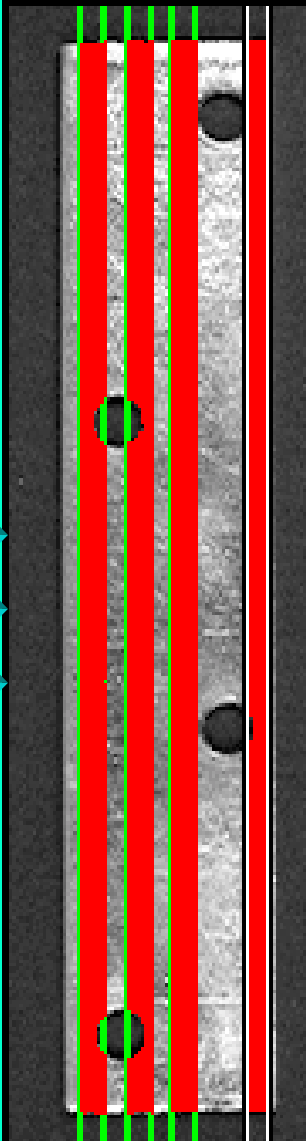
◆ 75 pixels per mm for width

Length Measurement – How the system works

Measurement Data		
File		
○ No Sort ○ Sort Up ○ Sort Down On: Diameter (r ▼)		
☑ Locate the object. ☐ Scroll to the object.		
Obj.#	Diameter (max)	Size (length)
19	24.583534	24.618713
20	24.579967	24.618778
21	24.541626	24.579853
22	24.541168	24.541138

◆ The holes illustrate possible damage, which can be detected.

Hole determination

Measurement Data

File

○ No Sort   ○ Sort Up   ○ Sort Down   On: [Diameter (r ▼]
☑ Locate the object.   ☐ Scroll to the object.

Obj.#	Area	Diameter (max)	Radius (max)	Radius (min)	Holes	Perimeter
11	1.0098823	1.2465073	.65621668	.51385444	7	3.8057106
93	1.0563309	1.2560867	.63466752	.53015810	5	3.8010883
278	1.1147662	1.2867274	.69485217	.53642243	3	4.0513721
366	1.0443442	1.2005851	.61433381	.50639474	2	3.6368053

◆ Holes measurement

Reporting Data

- ◆ SMS
- ◆ E-Mail
- ◆ Audio Alarm
- ◆ Visual Alarm
- ◆ Stopping Machine
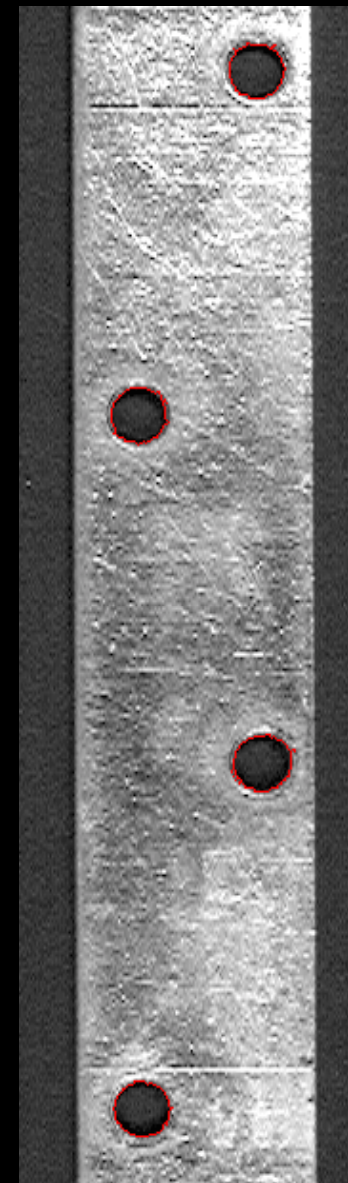- ◆ Other as required

Measurement Data

File

☉ No Sort ○ Sort Up ○ Sort Down On: Diameter (r ▼)
☑ Locate the object. ☐ Scroll to the object.

Obj.#	Area	Diameter (max)	Radius (max)	Radius (min)	Holes	Perimeter
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Summary

Supply a product measurement and recording system consisting of:

- Cameras (1 camera per task)
- Image frame grabber card
- IA Software
- Digital recoding
- Software to output the data or shift, invoice, etc.
- Alarm IF measurement exceeds set threshold
- Ability to SMS / E-Mail / update web site with data

References

B.T. Dudley. "Image Analysis and Waste Technology in Africa", Binary - Computers in Microbiology, 5, 3-4. (1993)

B.T. Dudley, A.R. Howgrave-Graham, A.G. Bruton and F.M. Wallis. "The application of digital image analysis to quantifying and measuring UASB digester granules", Biotechnology & Bioengineering. 42, 279 - 283. (1993)

Castleman, K. R. 1998. Concepts in Imaging and Microscopy: Color Image Processing for Microscopy. *The Biological Bulletin*. 194 (2): 100-107.

Russ, J.C. 1995. *The Image Processing Handbook*. 2nd ed. CRC Press. Boca Raton, FL.

Inoue, S. (1986). Video Microscopy. Plenum Press

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