

Mega Pixel Cameras[®]

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IP Cameras



Buyer Beware

- Most companies / Security Dealers are not trained on the benefits or the technology of IP cameras and so:
 - Tend to recommend against the use of IP cameras due to ignorance or lack of knowledge
 - Do not understand the subtle differences between IP cameras and so many units become misapplied and earn undeserved bad ratings
 - Do not have the connections to provide on site demonstrations.



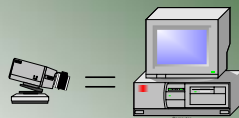
IP Cameras

- Start with digital images from the enhanced CCD imager
 - Require no conversion of the signal to add features, so can offer enhanced or higher resolution
 - Produce digital and analog signals simultaneously making them compatible to most situations

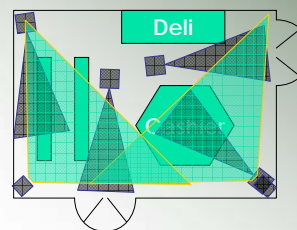


IP Network Cameras

- IP cameras can be standalone computer servers with all the features and function capabilities of a computer
- When IP cameras are computer servers, they can create their own LAN or WAN system
- When IP cameras are computer servers, they are not reliant upon outside "black box" technologies to add features



The OLD meets the NEW!




- OLD ... several cameras to cover several areas to maximize image size and resolution
- NEW ... one or two cameras covering the same area taking advantage of high resolution images and on board intelligence




The OLD meets the NEW!

- 16X the resolution of CIF cameras/DVRs
 - Image quality is superior (license plates, facial details, currency)
 - Digital Zoom without distortion


DVR (320 X 240) recording



IP - High Resolution




Thanks to IQinVision for Slide



IP Formats

- IP cameras come in a large variety of configurations allowing for a broad basis of applications.
 - CIF resolution standard and definitions were driven by the DVR industry and aligns with the analog NTSC (480 lines) and PAL standards:
 - CIF (352x240)
 - quarter of CIF = QCIF (176x120),
 - 4 times CIF = 4CIF (704x480)
 - The VGA (640x480) comes from the computer industry (first monitors were 640x480 pixels as you might remember)


Thanks to AXIS Communications for Slide



IP Formats


- JPEG and Motion JPEG
 - Resolutions: QCIF (176x120), CIF (352x240), 4CIF (704x480), SIF (320x240), VGA (640x480) all measured in pixels
 - Compression level from 0 to 100%
- MPEG2
 - Resolutions CIF (352x240), 4CIF (704x480)
 - Compression depending on bit rate - same quality of video and audio as on DVDs
- MPEG4
 - There is a lot of confusion with MPEG4 ... even the manufacturers are arguing over this one

Thanks to AXIS Communications for Slide



IP Formats

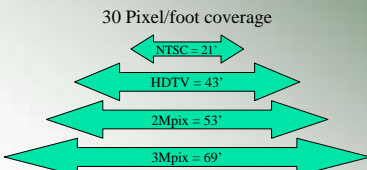
- Which format is better?
 - "None is better, it is still the same pixels. CIF is a few pixels wider, 704, while VGA is 640. Apart from that - no difference. In the analog world the technology is "stuck" with multiples of NTSC. In the digital world we can do anything from 1x1 pixels to 2000x2000 pixels (= 4 Mega pixel) which equals the resolution you have in a 35 mm 400 ASA film camera."




Its all about Pixels-per-foot

- You can't see details without pixels
- Face/License Plate Recognition need 30 pixels/foot
- The Mega-pixel covers better


30 Pixel/foot coverage




Thanks to IQinVision for Slide



Resolution improves Coverage



320 x 240
NTSC/PAL
HDTV
2 Mpix





Standard Features In IP Cameras

- Set up
 - with any PC via Ethernet connection
 - via portable computer via USB / Ethernet / Com support
 - via PDA via Bluetooth or wireless connection
 - Some cameras come with wireless features built in

IP Cameras Offer System Modernization

- Quick, plug & play capabilities incorporated with comprehensive features allow for integration as:
 - Functional additions or insertions to existing and/or expanding analog or digital video systems
 - Standalone, fully functional digital systems

Smart Cameras Are IP IP Cameras May Not Be Smart

- Smart Cameras take advantage of their computer base and incorporate various, specialized algorithms to perform unique functions
- Smart cameras often save the cost of expensive black box interface units

Smart Cameras Can Be Used For

- Smart Cameras provide more information (resolution) than analog cameras
- Digital Video makes it easier to extract information from the camera
- More sophisticated algorithms have been developed
 - People Counting
 - No-motion detection
 - License plate recognition
 - Wrong way detection
 - Face Recognition
 - Privacy Blocking

Digital PTZ

- Problems with Mechanical Pan Tilt Zoom Systems
 - Moving parts wear and break
 - Network delays create problems
 - Only one person controls the view
 - You only record what that person is viewing

Digital PTZ & the Mega Pixel Camera



Multiple users DPTZ while you
RECORD EVERYTHING, ALL THE TIME




Thanks to IQinVision for Slide

Digital Effects: People Counting


- Used to keep track of specific motion or traffic
- Will count people or objects moving one direction, while ignoring all other activity in area
- Can be programmed to reset after:
 - Specific time period
 - Specific count
 - Specific circumstances

Digital Effects: License Plate Recognition





- Used to keep track of vehicles parked in private lots
- Used as access control option to allow specific vehicles while disallowing others
- Used to track stolen vehicles on highway systems




Digital Effects: Facial Recognition


- Used for Access Control to:
 - Buildings
 - Computer Networks
 - Private Offices
- Used for tracking individuals in crowds
- Used for finding or locating individuals in crowds

Digital Effects: Privacy Blocking




- Used to block out specific windows or doors in private buildings in the camera's view
- Used to block out private scenes within individual scenes in the camera's view
- Can be used with Pan / Tilt / and or Zoom with full integrity




Compression

The technology of reducing the size of digital information files to improve the ability and speed of transmission and/or to reduce the space required for storage purposes.




Defining Digital Compression

- Compression:
 - Storing data in a format that requires less space than the original information
- There are two styles of compression:
 - Lossless compression:
 - Allows the original data to be reconstructed exactly from the compressed data
 - Lossy compression:
 - Decompressed file is "close enough" to the original data ... much loss




Defining Digital Compression Lossless

- Some compression schemes reduce the size of a file but always recreate the original file exactly.
- This is referred to as "lossless" compression.
- Lossless compression is important for very high-resolution image application such as medical imaging.
 - Increase the number of pixels per inch while decreasing the overall size of the image



Defining Digital Compression Lossy

- Some compression schemes reduce the size of a file by throwing out certain data. This is referred to as "Lossy" compression. This can be done by finding repetitive (or unchanging screen areas in moving video) pixels in an image, throwing out the repetition and then recreating the original image as closely as possible when it is uncompressed. However, anytime data is thrown out, the resulting recreation will have some "loss" associated with it.



Defining Digital Compression

- Digital code sequences can be very large and so are compressed to decrease bandwidth and increase storage capabilities


```
0001 0101 0011 0001 1000
0011 1010 0101 0001 0101
0011 0001 1000 0011 1010
0101
```

When compressed may become

```
0010 1100 0010 1100
```


The first two repeating sequences are redefined into a two sequence format

- Compression is accomplished through various, different algorithms called engines




Defining Digital Compression

- Codec:
 - Coder / Decoder
 - Device or program capable of performing transformations on data or signal stream;
- There are several tens (possibly hundreds) of individual codec schemes
 - Each is a variable of an original scheme
 - Each is designed to improve on a scheme according to the author
 - It is possible to have a player that cannot play back a file, even though the file has the right format identifier (i.e.: AVI, MOV, etcetera) because it does not have the right codec.




Defining Digital Compression

- Each engine has a name:
 - Jpeg / Mpeg / Wavelet / H-263 / etcetera
 - Each engine is the best to use in video ... according to the manufacturer using it.
- Each compression format has its own set of rules and strength and/or weakness
 - One engine may compress all shades of individual colors into a single color code
 - One engine may code out a full frame or image and for the next "X" frames code out only those items that changed or moved as compared to the initial image
 - One engine may cut the resolution or size of the image by eliminating every second, third, fifth or whatever pixel ... to conserve bandwidth



Defining Digital Compression Full Frame

- JPEG - *Joint Photographic Experts Group*
- Records every frame ... discard fine details and keep bigger blockier details and then code the results
- Tiles the details ... pulls several boxes into single larger boxes or squares of color.
 - Creates jug head technology
- Motion JPEG or M-JPEG




J-Peg Compression





Defining Digital Compression Full Frame

- Wavelet ...
- Infinite implementations ... everyone can do a different wavelet so no two are the same.
- Different from JPEG because it does not tile, looks at frequency ... high is noise ... low is black. ... applies to the whole frame built from the bottom.
- Only standard and shaky is JPEG 2000.
- Wavelet applies without blocking but still has loss
 - built up from the background but still drops out the detail to avoid size
 - Wavelet is capable of doing great compression, but still drops the fine detail. Blurry or soft but not blocky.



Defining Digital Compression Traditional compression schemes


- Take a series of images and compare one to the next looking for only the changes...
- MPEG - *Motion Picture Experts Group*
- Six standards
 - MPEG 1
 - MPEG 2
 - MPEG 3
 - MPEG 4
 - MPEG 7
 - MPEG 21
- Video, for the most parts works with MPEG 1 & 2 & 4



Defining Digital Compression MPEG

- I-frames store full frame
- B-frames look back and store only those things that have change ... then look forward to verify
 - B-frame can become corrupt and then build on that corruption working forward.
- P-frames only look back

I	Intra frames
B	Full compress frame B-frames = Bi-linear Frames
P	P-frames Preceding & subsequent




Defining Digital Compression MPEG

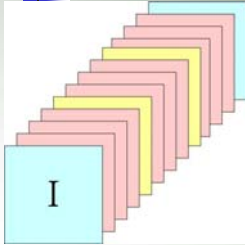
- Files sizes range from 1.4 to 12 kb very efficient form of compression ...
- I frames at a fixed rate ... I frame will always be first frame ...
 - The more I frames the more space for storage required. The less I frames the more potential for corruption.
- Different MPEG standards varies the number of I frames and B/P frames ...
 - I-frame is always first
 - B-frame looks back and forward to compare
 - P-frame only looks back ...

I B B P I B B P I B B P


- It is possible that the only frames accepted into a court would be the I frames since they are the only whole frame ... Almost impossible to say that the B and P frames are accurate to what was actually stored.





Defining Digital Compression MPEG



- The more frames between I Frames, the more compression ... the more room for corruption.
- Too much compression and image memory or bleed over may be realized.




Defining Digital Compression MPEG


Defining Digital Compression H-263 - Conditional compression

- Standard for video telephony and conferencing
 - H.261 - H.263 - H.263+ - H.263++
- Algorithm
 - Images processed with JPEG-like compression ...
 - Motion compensation prediction
- A car moving ... once established, the car is made and moved forward ... and so does not save changes so ends up predicting the motion. Does not record differences but moves the motion forward and refreshes the background ...
- Files sizes range from .54 kb to 8.77kb
- H-263 does not handle rapid motion because of it trying to predict forward motion... backgrounds may show though ... fast motions may become missed or locked after the fact.




Defining Digital Compression Methods of compressing video information

- Reduce Frame Rate: redefine the number of images required per second
 - Static – A fixed variable ...
 - 60 fields per second is reduced by a compression rate of 3:1 = 20 images per second is recorded
 - 60 fields per second is reduced by a compression rate of 5:1 = 12 images per second
 - The static rate is set by the original encoding by the manufacturer and is fixed.
 - Variable – A programmable variable ...
 - Each input is programmable according to the amount of information required:
 - Camera 1 = 5 Images per second
 - Camera 2 = 30 Images per second
 - Camera 3 = 1 image each twelve minutes





Defining Digital Compression Methods of compressing video information


- 16mm Movie Film ... "Real Time" = 25 frames per second
- Analog ... "Real Time" - 2:1 interface, NTSC standard = 60 fields / 30 frames per second
- Analog ... "Real Time" - 2:1 interface, PAL standard = 50 fields / 25 frames per second
- Digital = X frames / images per second according to manufacturer design and/or programmable requirements



Digital Compression Pitfalls


- Two major problems with decompression of digital signals:
 1. Color distortion
 - Combining shades of individual colors to preserve bandwidth means that they play back as a single color
 2. Detail or resolution losses
 - Eliminating pixels to make the image smaller means that they are no longer available for playback



Digital Compression Pitfalls

- No standards for compression engines in the CCTV market
- Incompatibility between formats
- Number of images per second and quality of images determine the amount of storage space necessary to store visual information
 - Storage space is dictating the amount of information being stored, not security or evidence needs



Questions?
Answers?
Now is the Time!

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