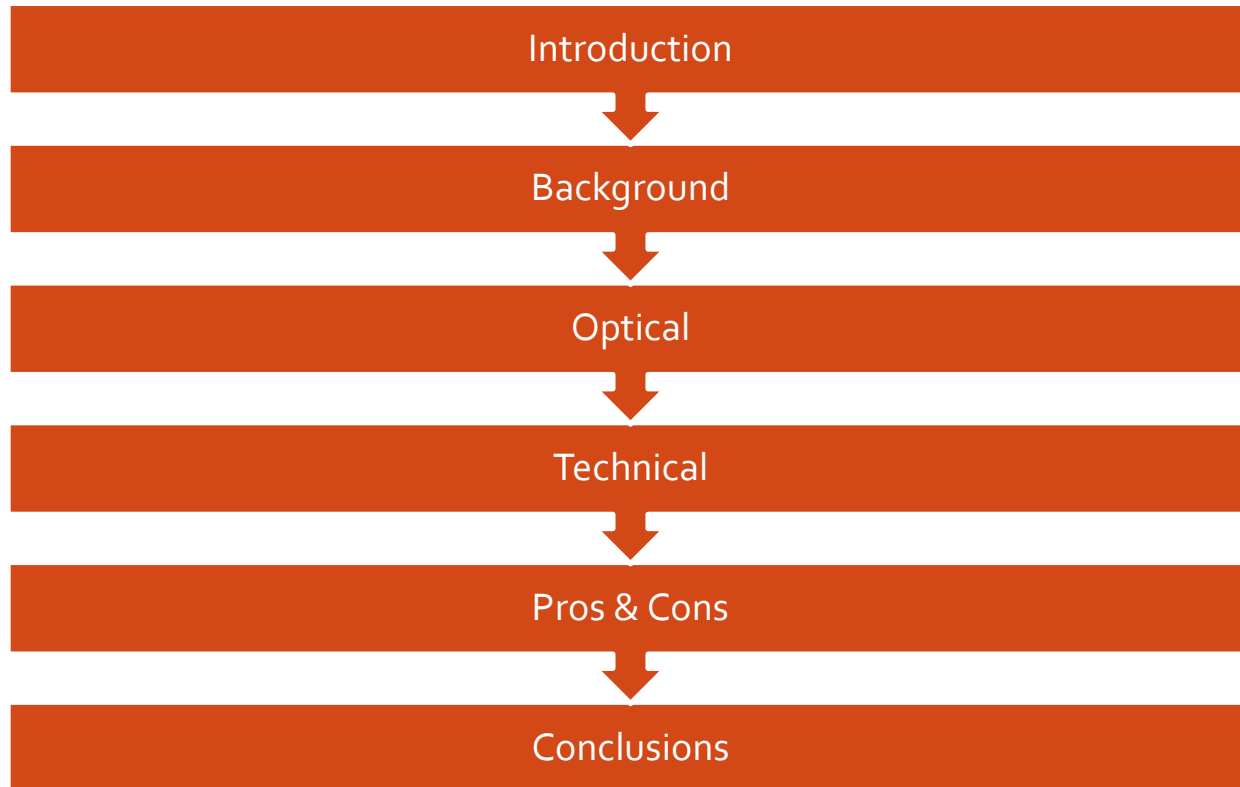




VIDEO SURVEILLANCE

Differences between IP Camera and Analogue Camera

Overview



Introduction

This presentation demonstrates the differences between IP Camera and Analogue Camera in terms of technical and optical features.



Optical

- Physical structure
- Lens and sensors
- Sensitivity

Technical

- Physical features
- Image processing
- Functionalities and software

Background Knowledge

Camera – a device records images

Basic components:

- A lens / a few lenses
- A sensor
- Signal-processing chips

How?

Light passes through the lens then project onto an image sensor.

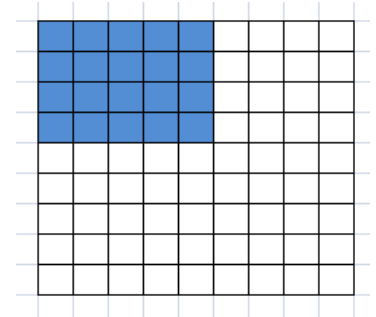
Image sensor 'converts' light (photons) to voltages and then produces signals.

Background Knowledge

Quality of images/videos

Key aspects:

- Focal length – how far the object can be captured. A short lens with less mm (12 for example) provides a very wide angle of view.
- Sensors
 - CCD – Charge-coupled device. Every pixel's charge is transferred through one output node to be converted to voltage.
 - CMOS – Conversion is performed individually for each pixel. Often includes a ADC.
- Chips efficiency
 - High-end cameras have powerful chips. More functions.



What is IP Camera?

A digital camera uses Internet protocol to transmit captured videos over network.

It has built-in software.



What is Analogue Camera?

Transmits captured videos through specific coaxial cable.

It has no built-in software.



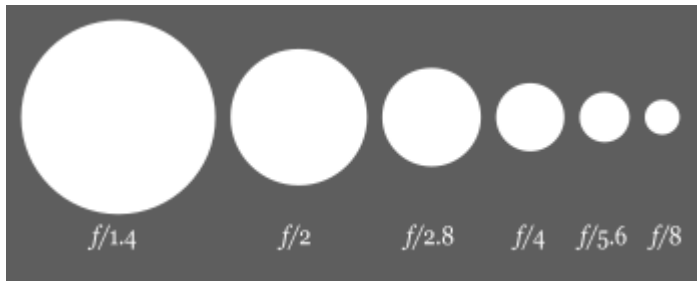
Optical analysis of Analogue Camera

Focal length – ~10mm, normally fixed

- a very wide angle of view

Aperture – F1.6 (normally)

- It determines the cone angle of a bundle of rays that come to a focus in the image plane.



- wide aperture - fast shutter speed

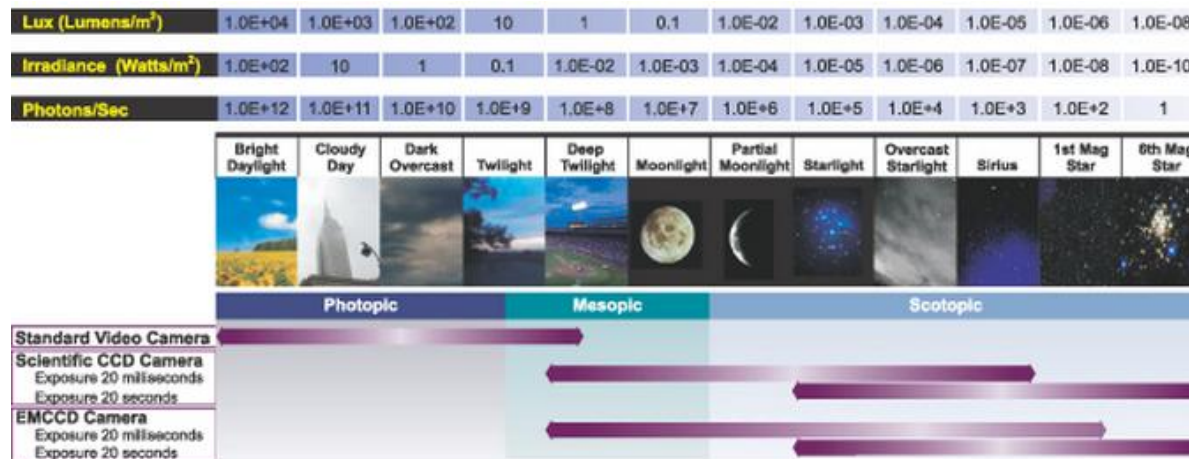
Optical analysis of Analogue Camera

Sensor – CCD (Charge-coupled device)

- High fidelity
- Great light sensitivity
- It could capture a high quality image, but sensor is slow.
Because of physical implementation.
So not good at on capturing moving-pictures.
- Sensitivity: some products could achieve zero – lux.
- What is Lux ?

Optical analysis of Analogue Camera

Darker background – low lux



So analogue cameras have a great sensitivity, which means it has wide dynamic range due to greater ability to deal with different light condition such as low light or high light situation!

Optical analysis of IP Camera

Focal length – ~3-12mm, variable

- a very wide angle of view, a variable would be more flexible

Aperture – F1.4 (normally)

- Wider than analogue camera
- wider aperture - faster shutter speed



Focal length 12 and 55 mm

Optical analysis of IP Camera

Sensor – CMOS (Complementary metal–oxide–semiconductor)

- Digital hardware system
- synchronized light- electric signal conversion, so sensor is fast.
- Amplified and noise-correction for each pixel.
- ADC at end
- It could capture images quickly, but image quality is lower. Because of physical implementation.

Optical analysis of IP Camera

- Sensitivity: some products could have 0.05 lux, some are ~1.0 lux
- No problems on day time, not as useful as analogue camera under low lightsource situations.
- WDR (wide dynamic range) technology – solve problems
 - Scans the same frame twice – once by slow sensor, then high speed sensor.
 - Processing two frames together and result in single frame.
 - Clear and low noise image.

Technical analysis of Analogue Camera

- Uses 12V DC power supply
- Working environment: -5 ~ 60 degrees
- Not flexible, some products only allow 20 degrees tilting adjustment.
- Automatic background lighting compensation, but it has less choice of modes.
- Conversion from analogue to digital for image processing, then back to analogue for transmission.

Technical analysis of Analogue Camera

Specifications

NTSC

60 hz refresh rate (30fps)
resolution :510*492

PAL

50 hz refresh rate (25fps)
resolution :500*582

The refresh rate is usually determined by the control system e.g.
DVR (usually lower than the specifications)

Technical analysis of IP Camera

- Uses 12V DC power supply or PoE (power over Ethernet)
- Working environment:
 - -30 ~ 50 degrees – 12 V
 - -5 ~ 50 degrees – PoE
- Function of view angle adjustment.
 - 360 degrees on panning and rotating, 180 degrees on tilting
- Advanced technology – WDR, many modes for background lighting compensation.
- Conversion from analogue to digital for image processing, then sends out the signal.

Technical analysis of IP Camera

- Specifications for resolutions:
 - SXGA 1280*1024
 - 720p 1280*720
 - VGA 640*480
- 30 fps with VGA, but 8 fps with SXGA
 - Because of huge amount of information processing
 - Could have better fps with powerful chips.

Technical analysis of IP Camera

Advanced functions in IP camera

- Audio input/output
- Video compression (includes audio) with H.264/MP3, MPEG4 compression standards.
- Almost supports all higher level protocols.
 - Such as TCP, DHCP, 3GPP
 - Easy to build a centre control system with remote control.
- SDKs, APIs are available
 - So user can program infinite many functions
 - Motion detections, camera password protection.

Advantages of Analogue Camera

Low hardware
cost

Large variety
of design

Higher
dynamic
range

Advantages of IP Camera

Full digital
technology

Better
resolution

PoE

Remote

Two way
audio

Secured
system

More
functions

Angle
adjustment

Disadvantages of Analogue Camera

Low video
resolution

Limited
functions

Remote
control is hard
to achieve

Disadvantages of IP Camera

High cost of
cameras

Compatibility
problems

Internet
security
problems

Lower
dynamic
range

|| Choose Analogue or IP Cameras

Analogue Camera

Low cost is attractive. It provides a not bad image quality, at least the control centre knows what happens to the monitored objects.

It has a built-in higher dynamic range features.

IP Camera

High resolution and/or high fps are the advantages. Even image is zoomed, quality is still good. IP camera could be consider as a simple programmable PC – SDK&API allows programmer develops many functions.

Conclusions

- IP camera has better features than Analogue camera
- They have different sensor, hence they could be more suitable under different situations.
- IP camera has better resolutions and refresh rate, it is powerful under condition that has enough light incident.
- Resolution is important for evidence purpose monitoring. Jerkiness is important for security monitoring.

Thank You

Questions?

